Yolo County Full-Scale Landfill Bioreactor (EPA Project XL)

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Bioreactor Landfills
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Presentation Summary

- Project Objectives and Goals
- Achievements to Date
- Project Results
- Project Challenges
- Conclusions

Project Partners

- Project Partners:
  - California Integrated Waste Management Board
  - California Energy Commission-PIER
  - National Energy Technology Laboratory, U.S. DOE
  - Western Regional Biomass Energy Program, U.S. DOE
  - Institute for Environmental Management (Tech. Support)
  - U.S. Environmental Protection Agency
  - Solid Waste Association of North America
  - California State Regional Water Quality Control Board
  - California State Water Resources Control Board
  - California Air Resources Control Board
  - Yolo-Solano Air Quality Management District
  - Yolo County Environmental Health

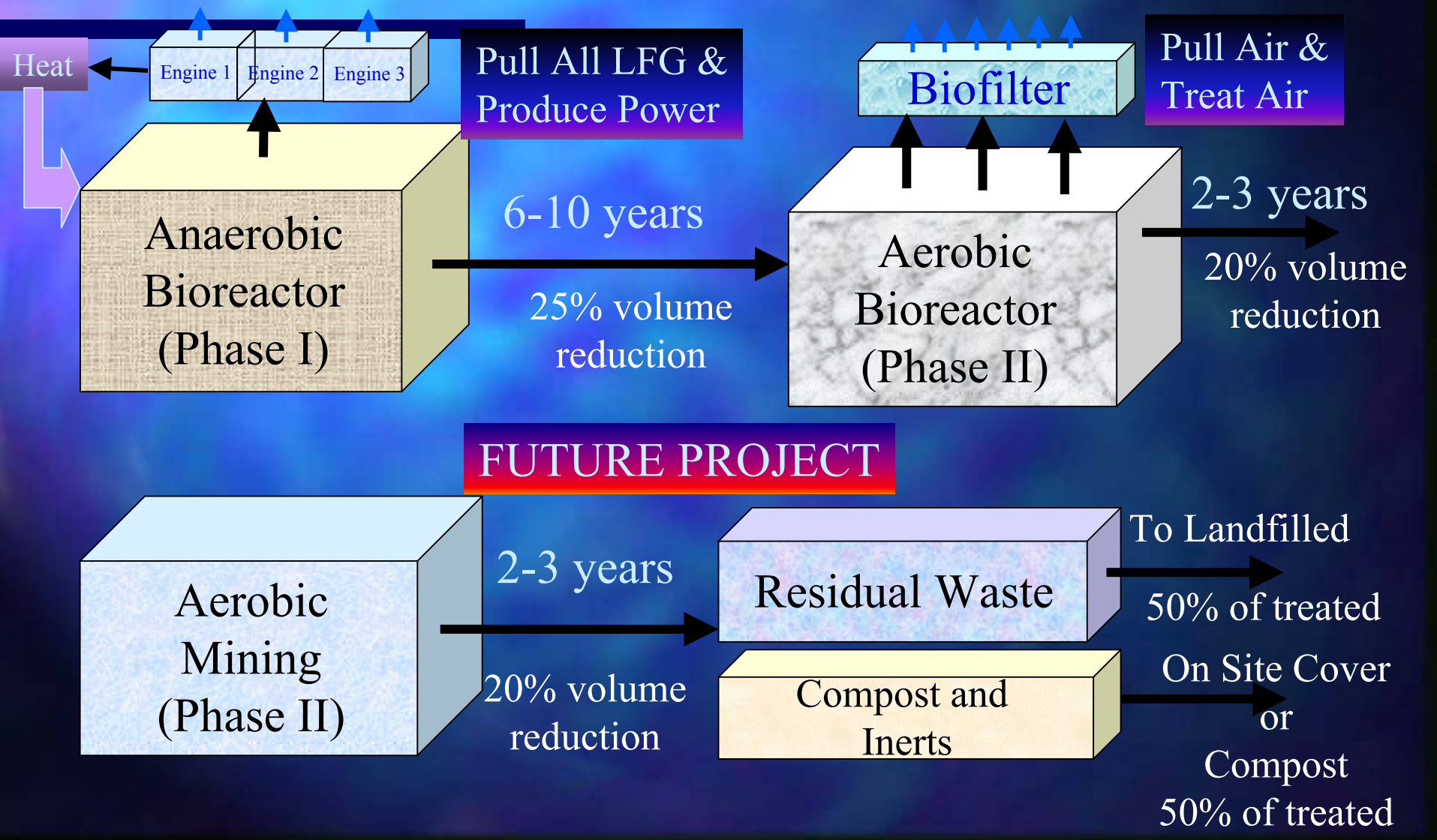
Project Objectives

- Demonstrate landfill full-scale operation to accelerate methane generation (anaerobic) and eliminate methane production (aerobic) through liquid addition without significant liquid head build up over the base liner
- Document and provide project technical data to regulatory agencies for permitting an acceptance of full-scale bioreactor operation (EPA project XL)
- Improve methane gas efficiency capture of nearly all methane generated without impact to air quality
- Determine cost benefit ratio for full-scale operation

Project Goals

- Instrument landfill to collect and analyze:
  - Landfill gas volumetric flow, temp., composition
  - Landfill leachate volumes, temp., pH, chemistry
  - Landfill waste temp., moisture content & settlement
  - Measure liquid level above the landfill base liner
  - Parasitic energy use for operation
- Develop mass balance and model leachate and methane gas generation over time
- Develop cost benefit ratio for the project

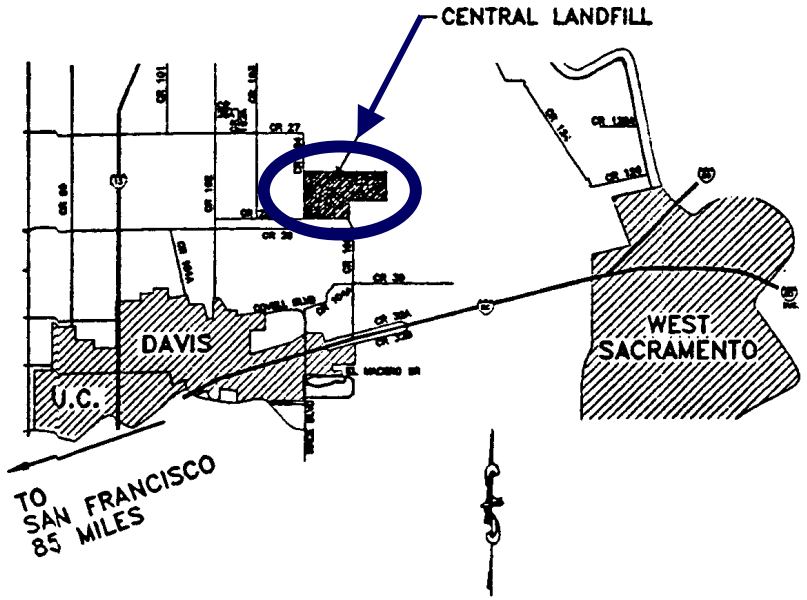
Anaerobic & Aerobic Process for Treatment of Waste



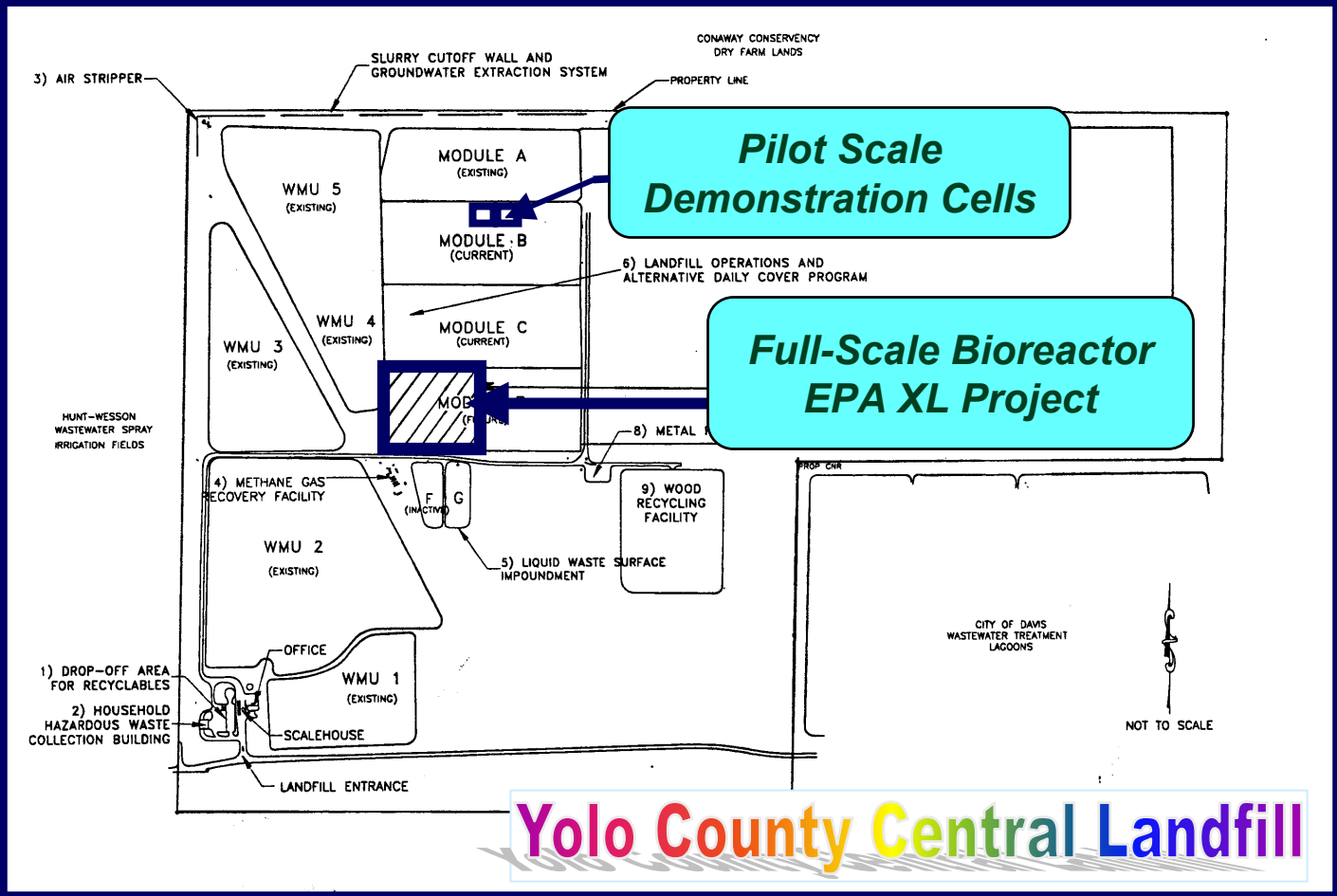
Project Location Map

California

Woodland



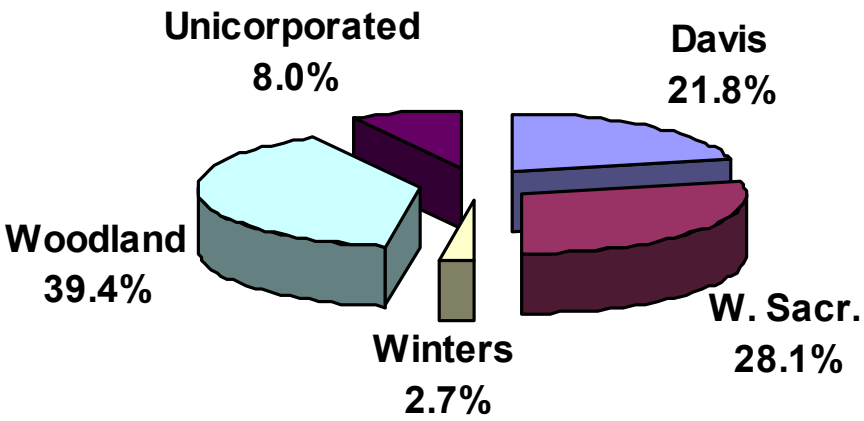
Project Site Map



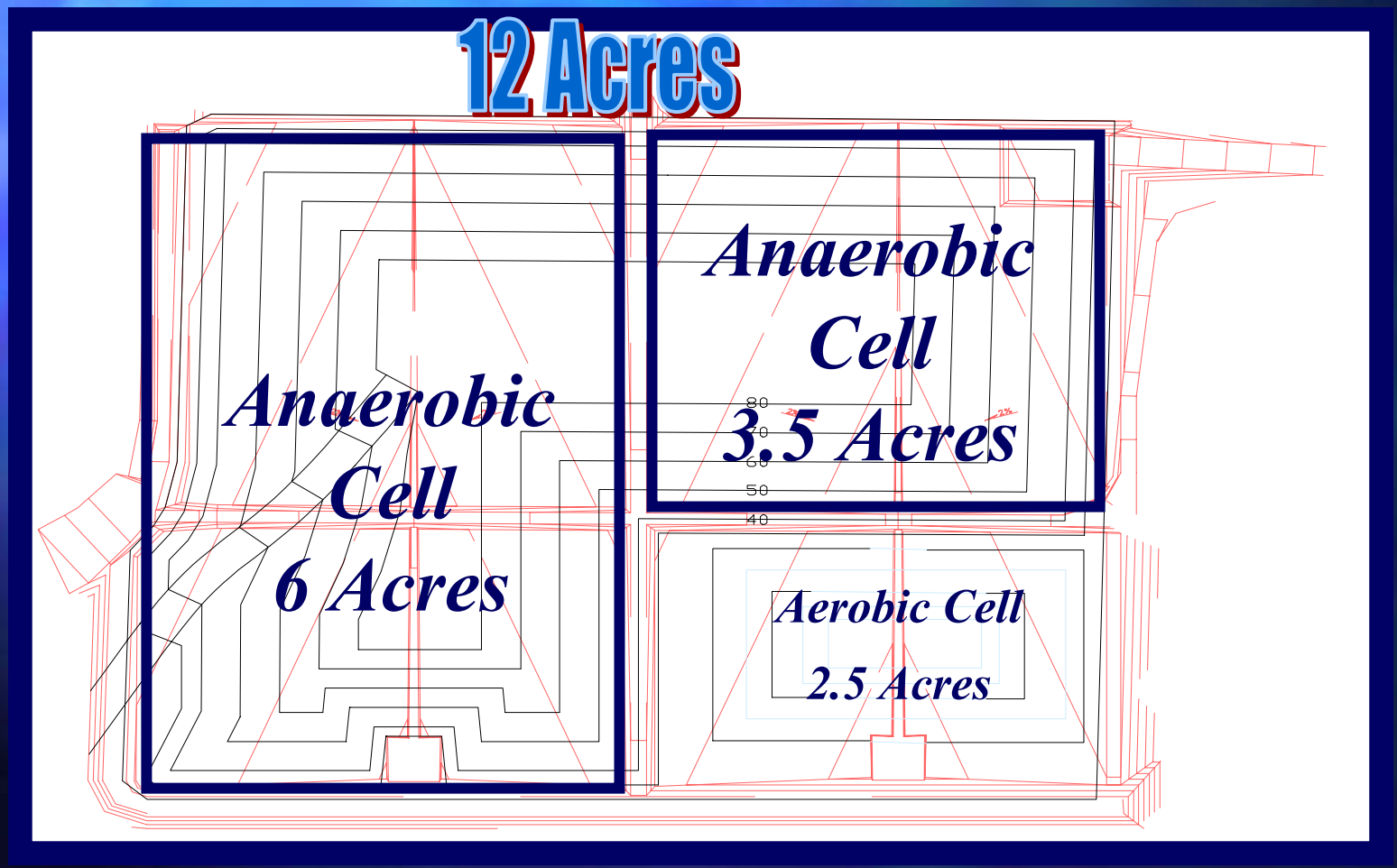
Project Summary

Yolo County Waste Percent by Weight

(44% Residental, 42% Commercial, 14% Industrial)



Full-Scale Project Site Map



Achievements to Date

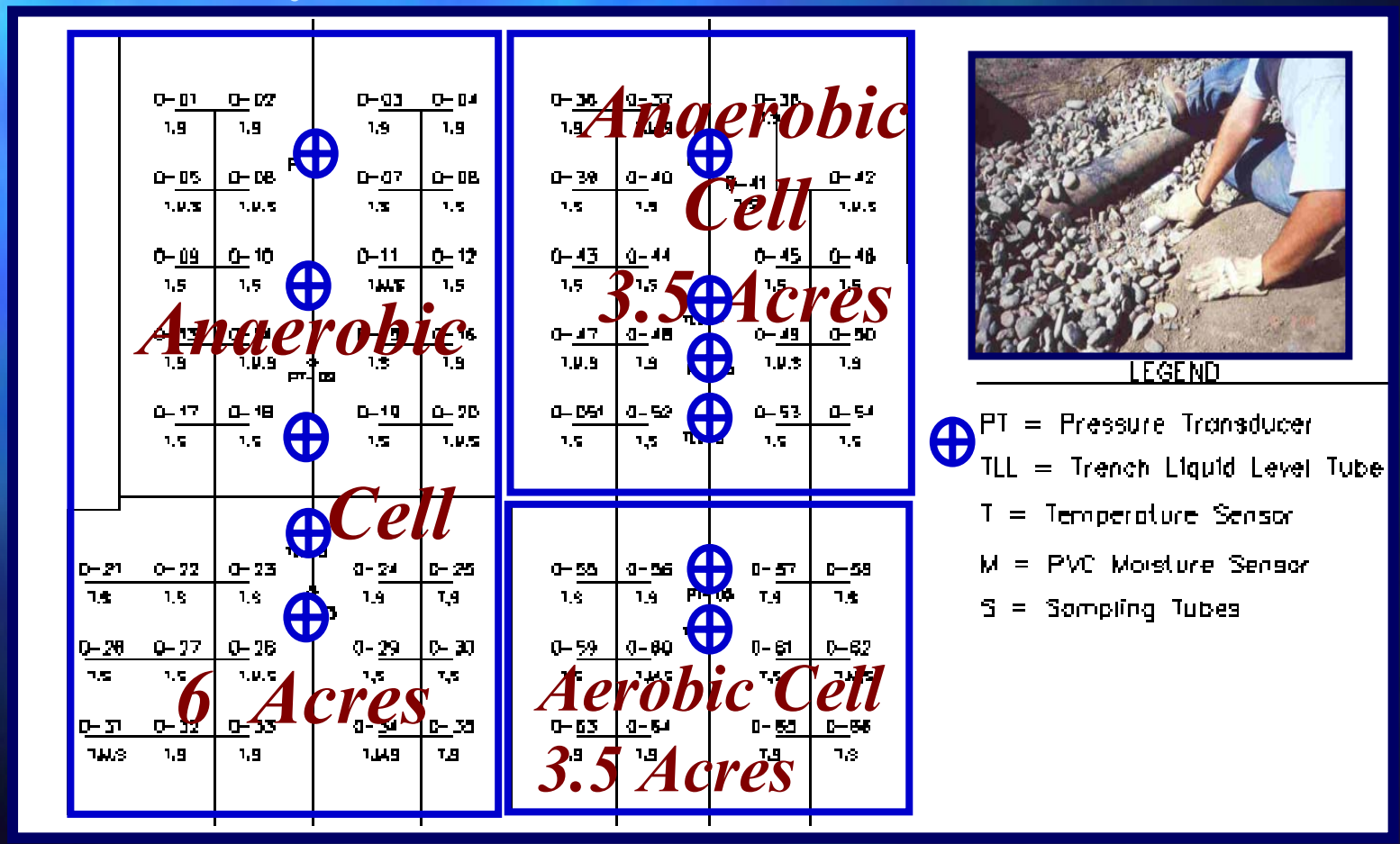
- Construction of base liner system

Achievements to Date

- Construction of landfill waste filling

Achievements to Date

- Base Layer Instrumentation

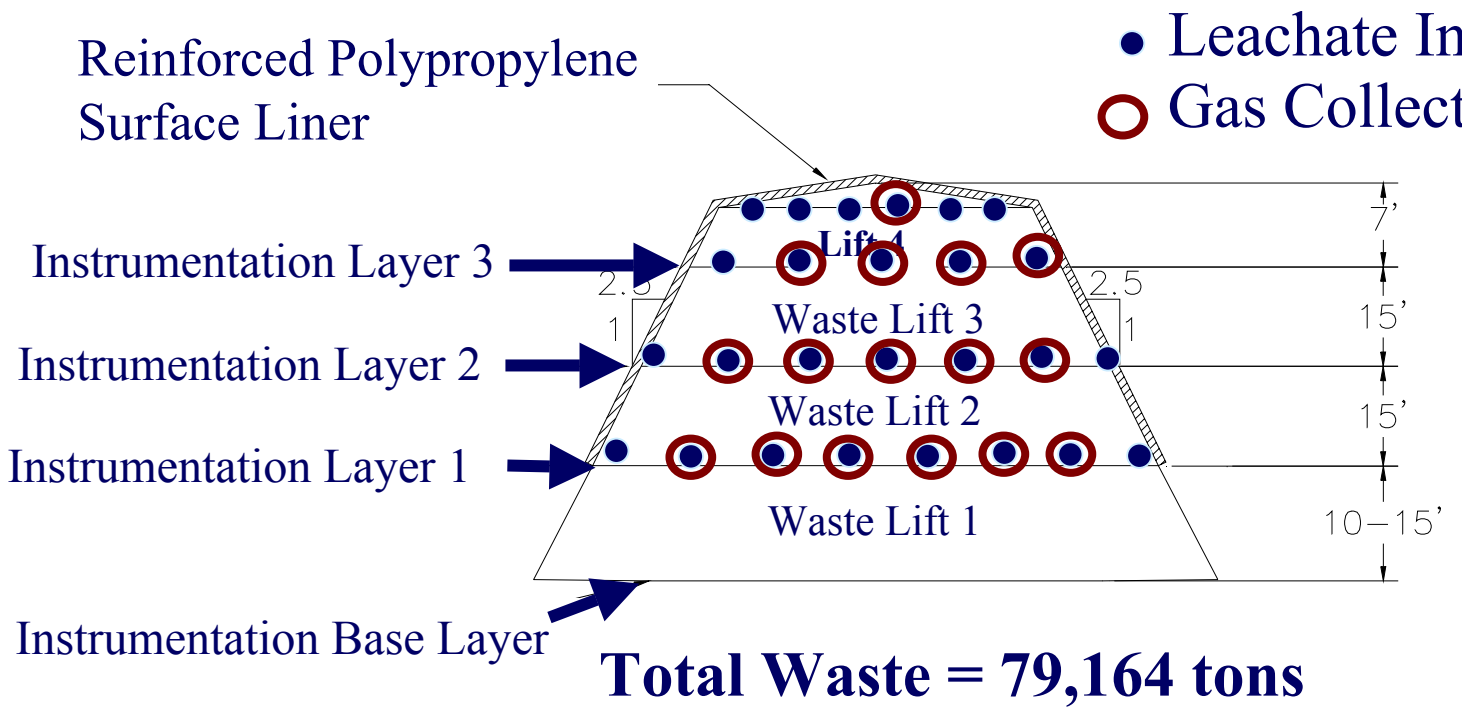


Achievements to Date

- Construction of the instrumentation system (Temperature, Moisture, Tubes)

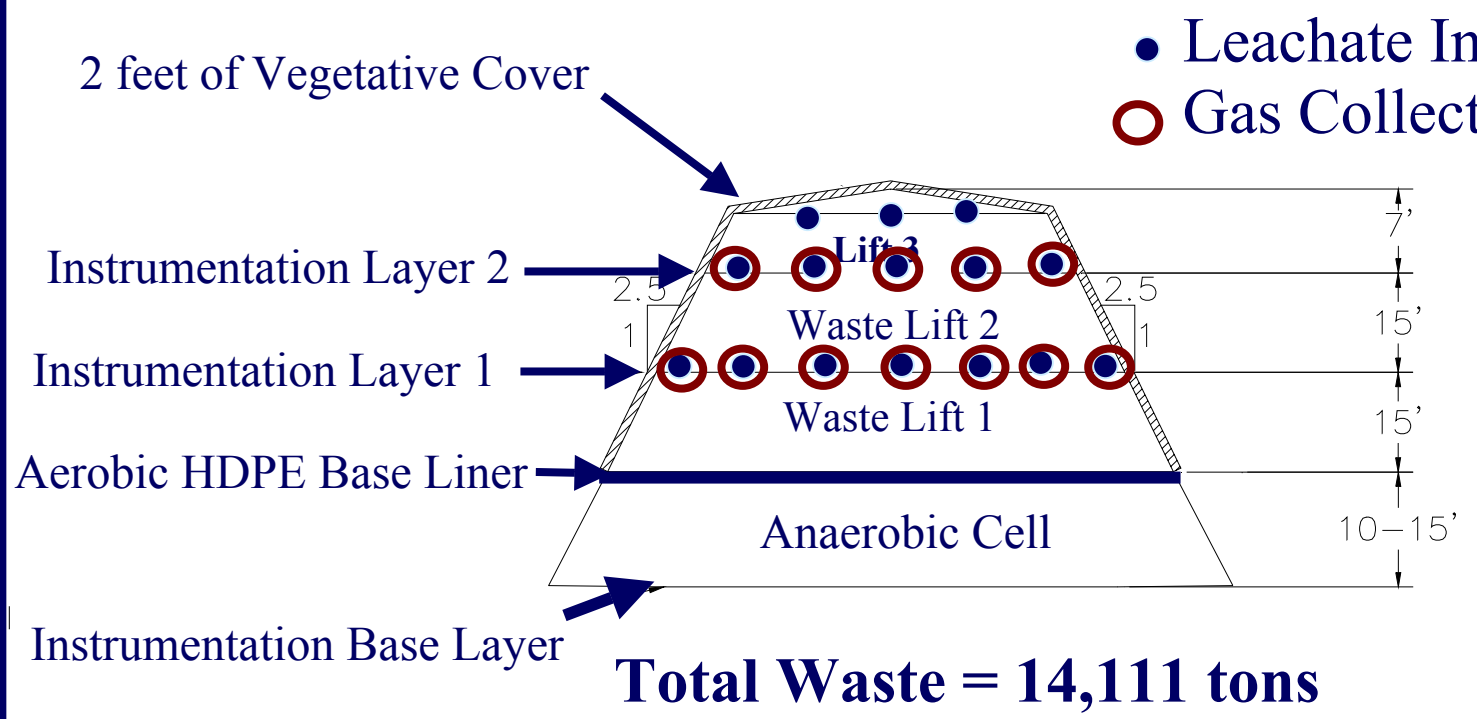
Achievements to Date

- Northeast 3.5-acre anaerobic cell x-section



Achievements to Date

- Southeast 2.5-acre aerobic cell x-section



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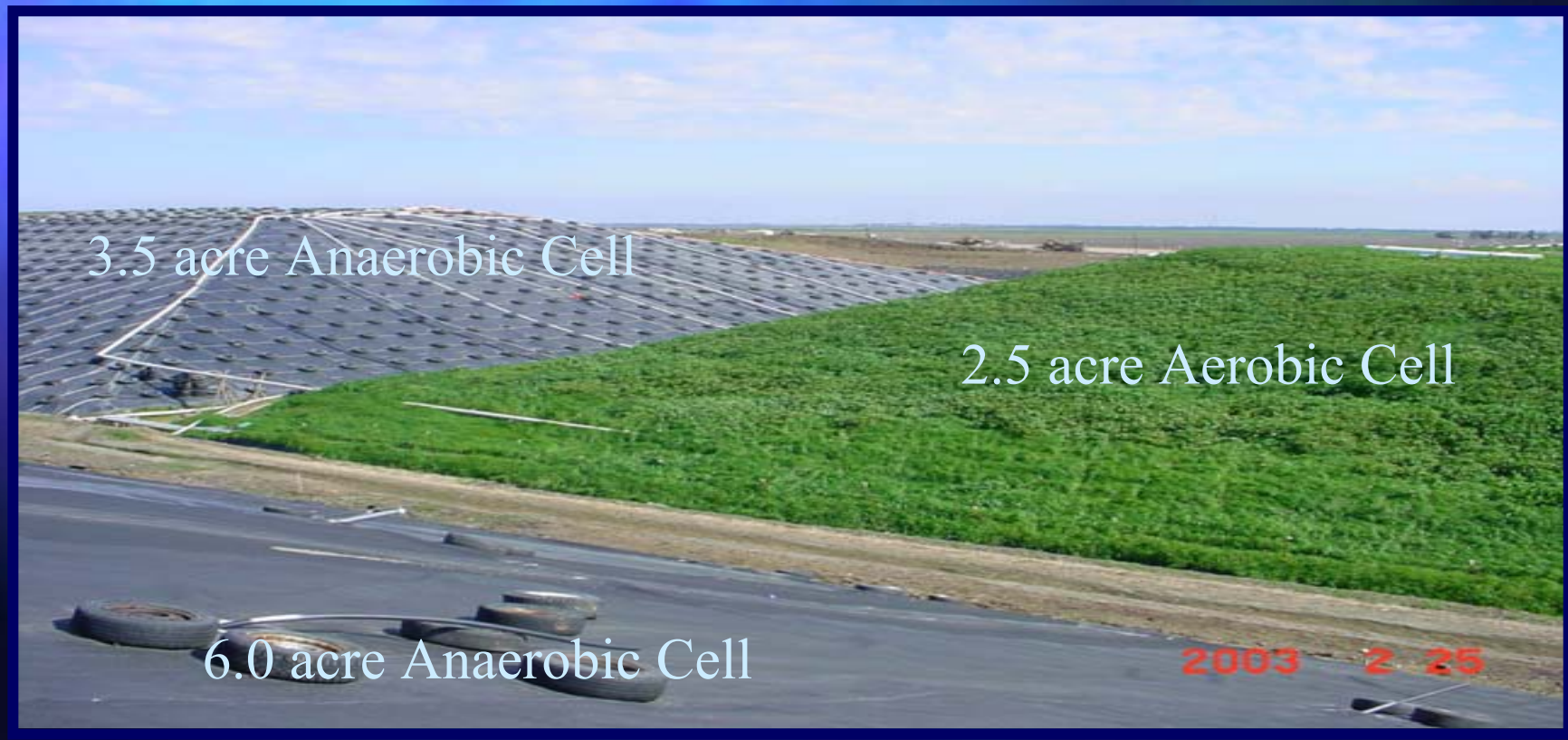
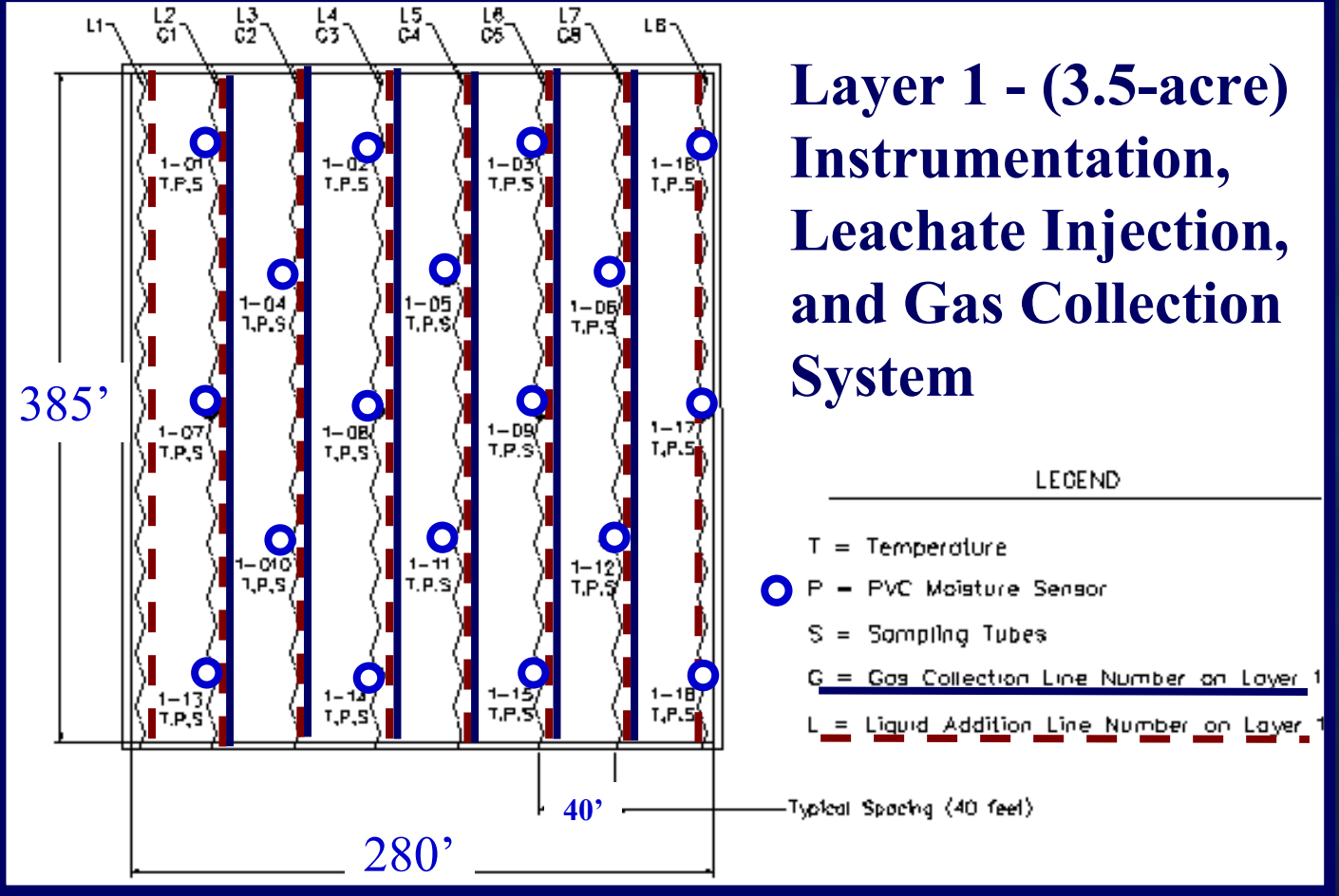


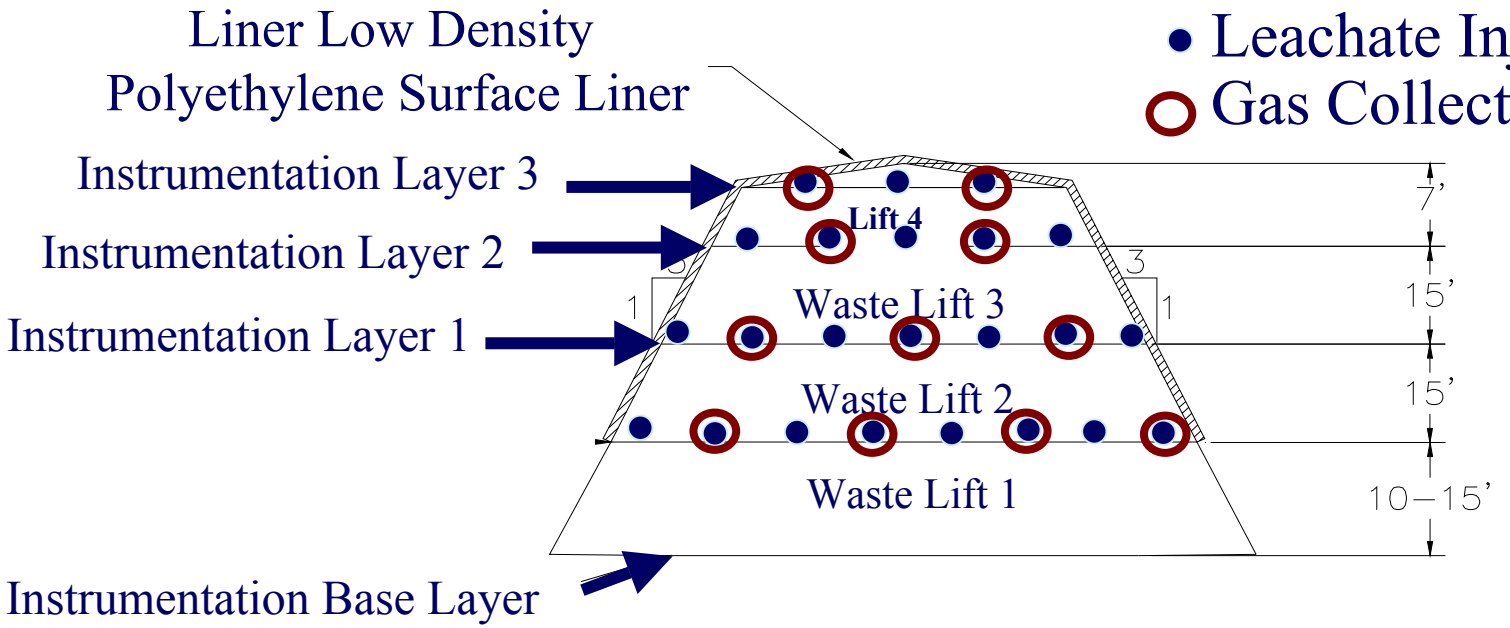
Achievements to Date



Layer 1 - (3.5-acre) Instrumentation, Leachate Injection, and Gas Collection System

Achievements to Date

- West 6-acre anaerobic cell



Total Waste = 193,852 tons

Achievements to Date

- Construction of landfill gas collection and removal system

Achievements to Date

- Construction of leachate recirculation and pumping system

Achievements to Date

- Construction of leachate injection lines

Achievements to Date

- Construction of cover system

Achievements to Date

- Construction of cover system

Achievements to Date

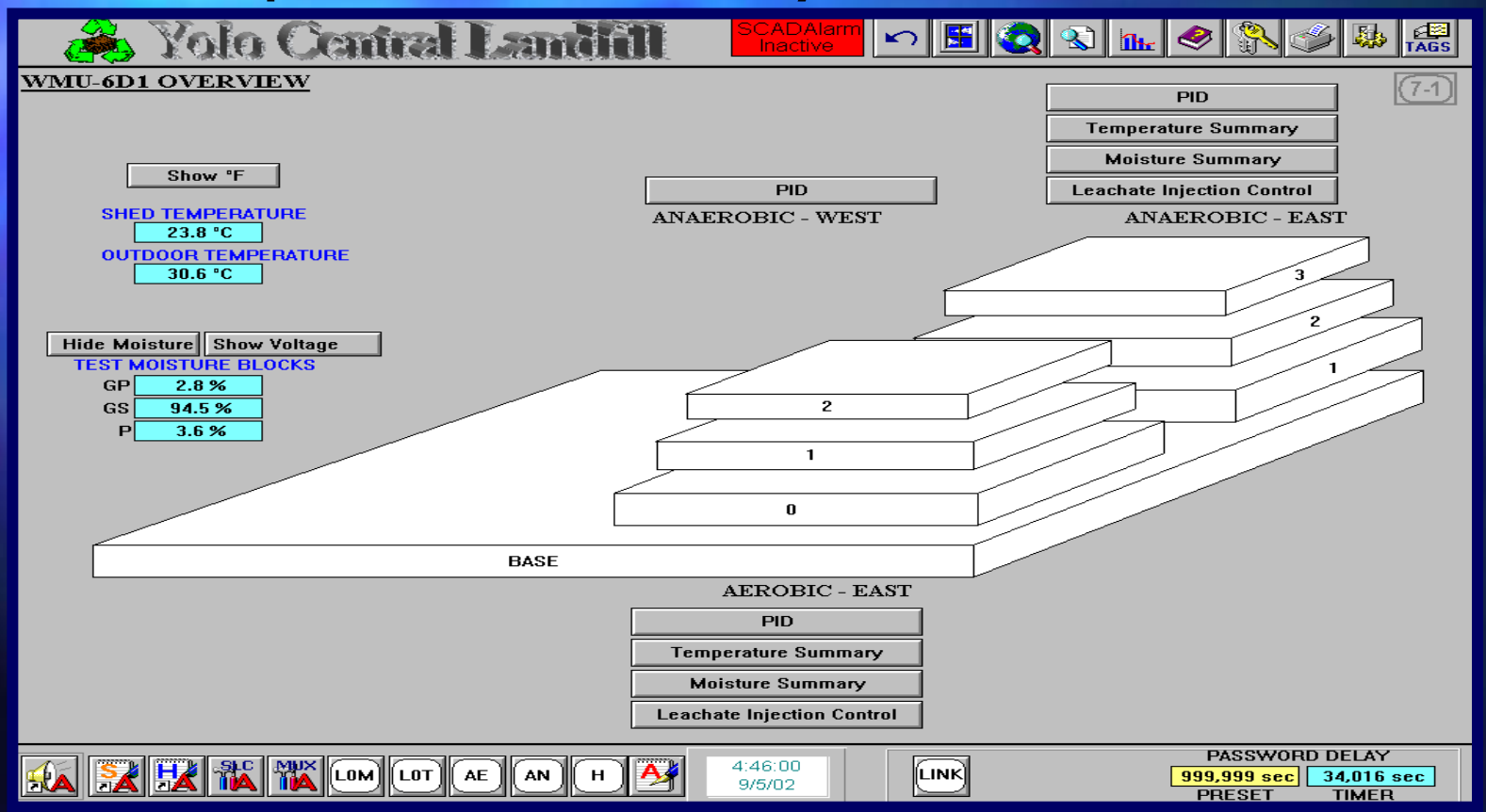
- Aerobic Blower and Biofilter System

Achievements to Date

- Construction of the SCADA System

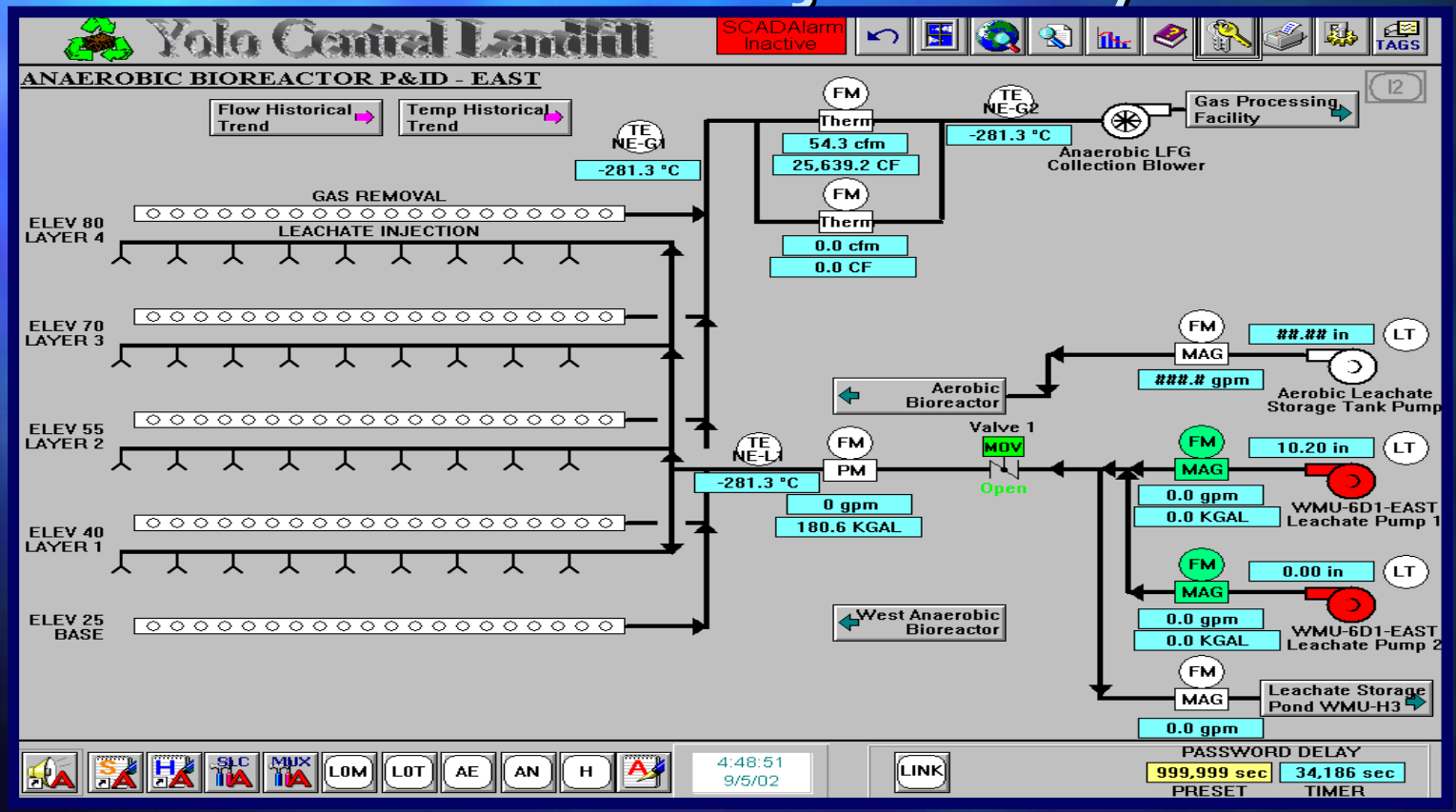
Achievements to Date

- Computer SCADA System



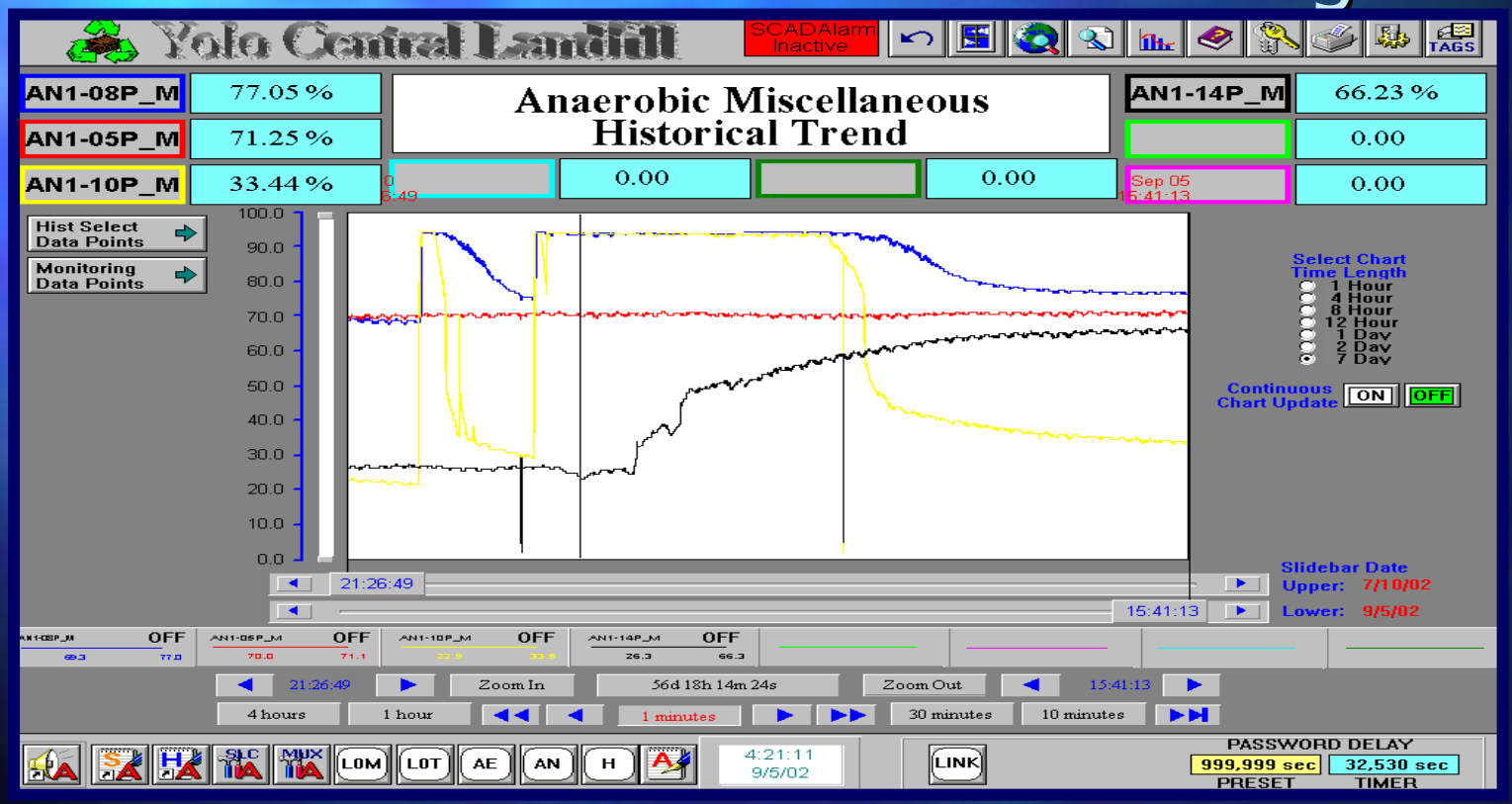
Achievements to Date

- SCADA- Leachate Injection System



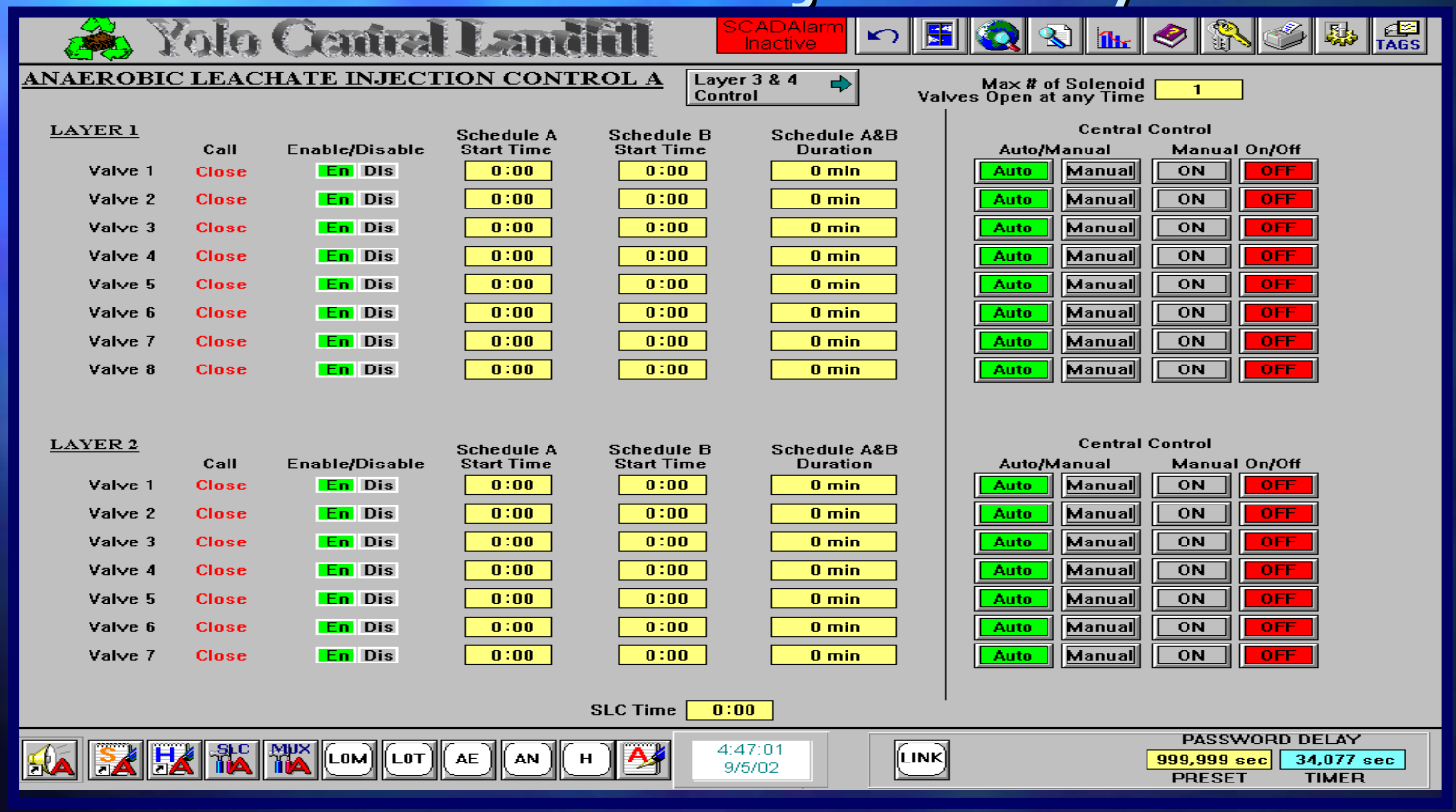
Achievements to Date

- SCADA- Real time data monitoring



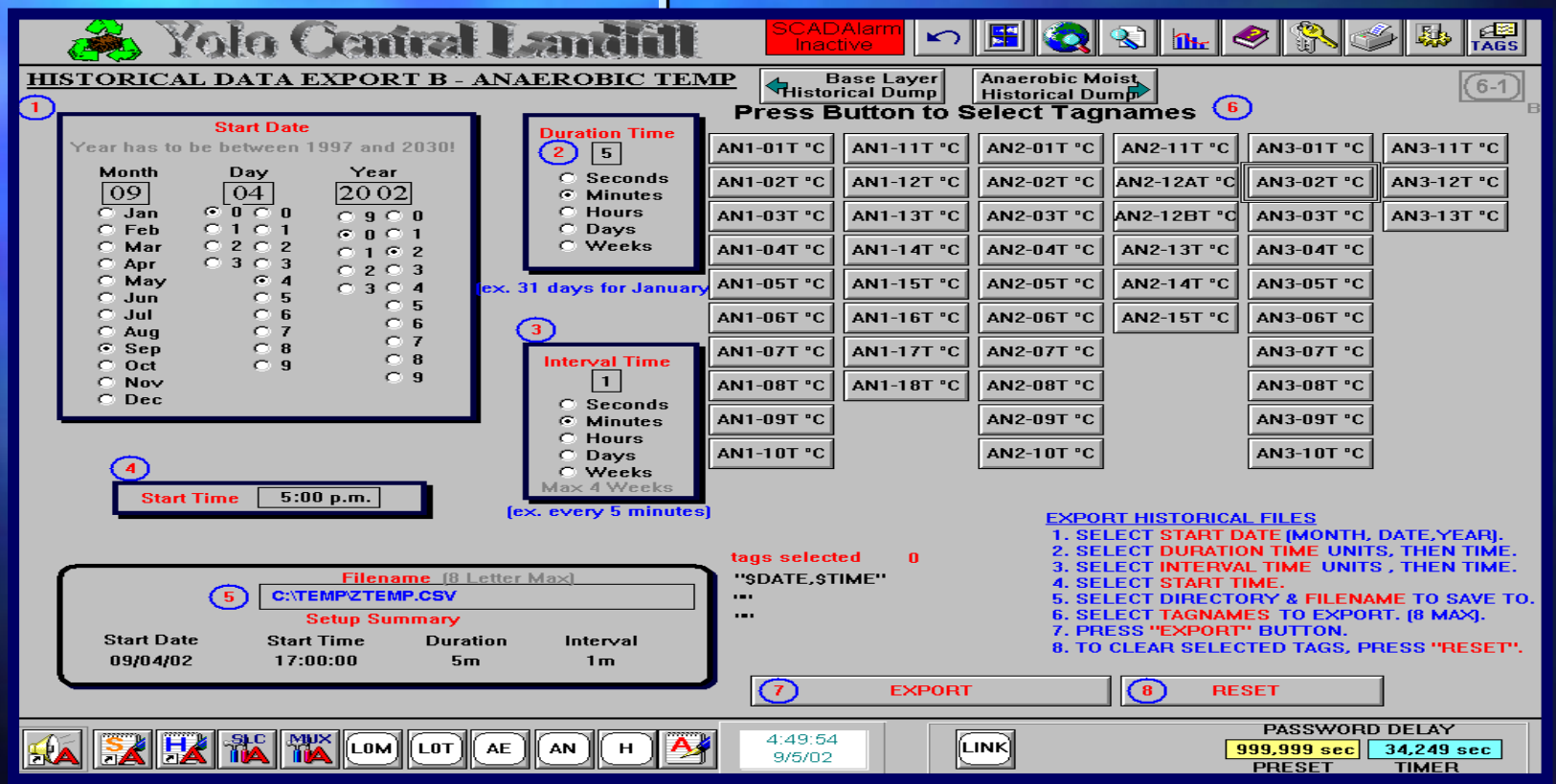
Achievements to Date

- SCADA- Leachate Injection System Control



Achievements to Date

- SCADA- Data export to database



Achievements to Date

- First waste sampling and BMP testing

Achievements to Date

- First & second waste settlement survey

Achievements to Date

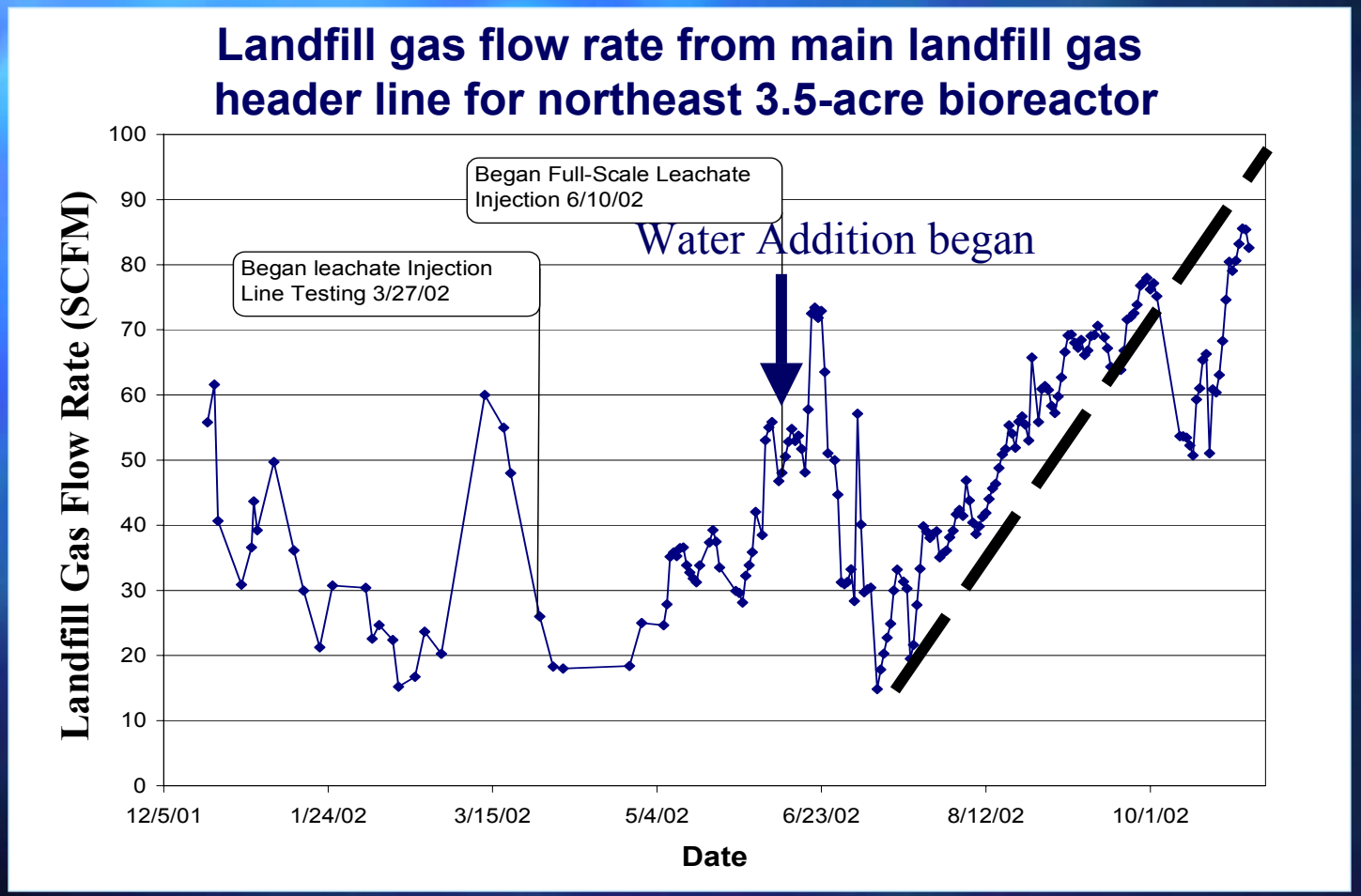
- Fugitive methane emissions monitoring using FID/PID Vapor Analyzer (FOXBORO TVA-1000)

Achievements to Date

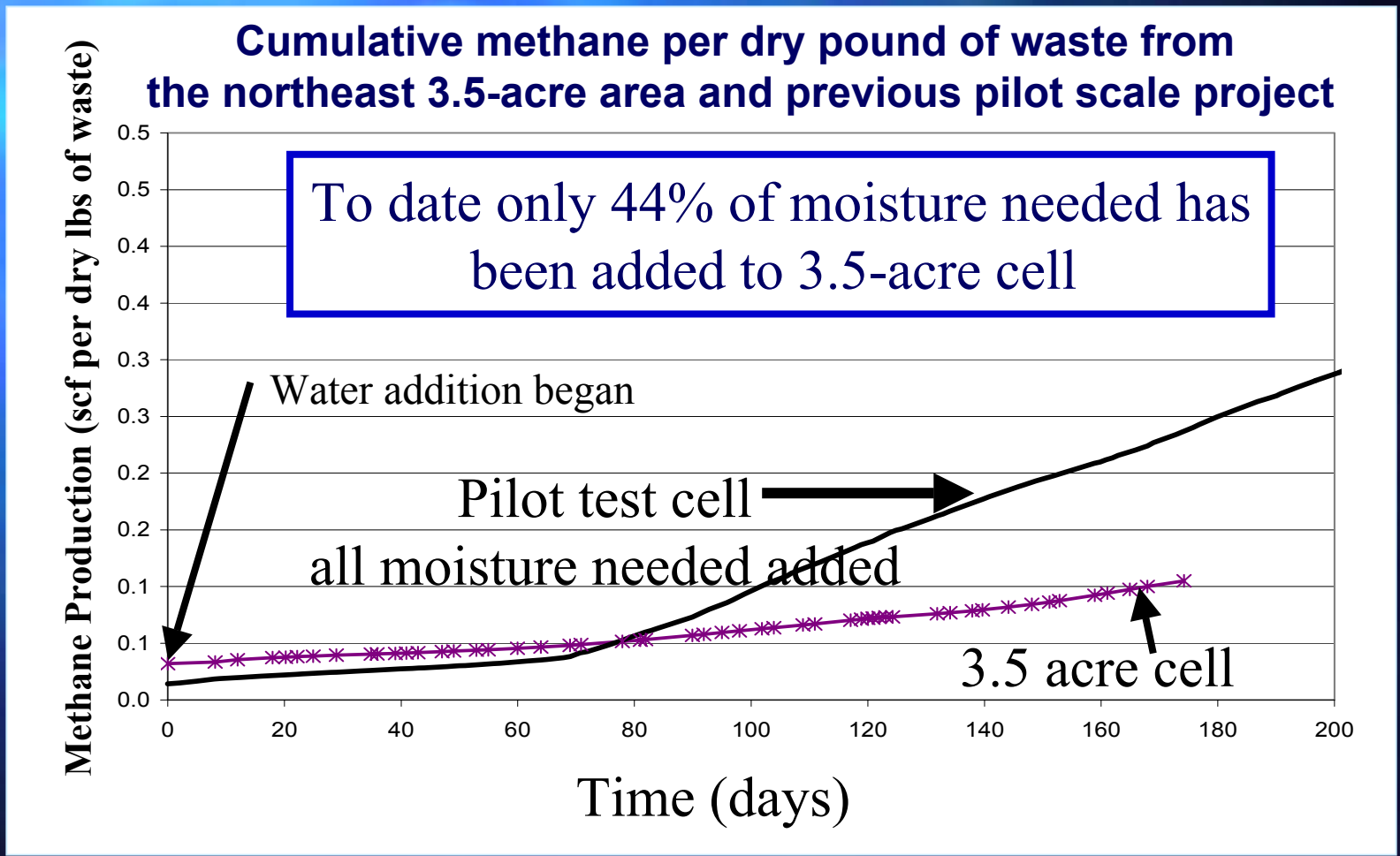
- Landfill gas sampling (LANDTECH GEM-500) and laboratory testing
- Leachate sampling and laboratory testing

Full-scale project results

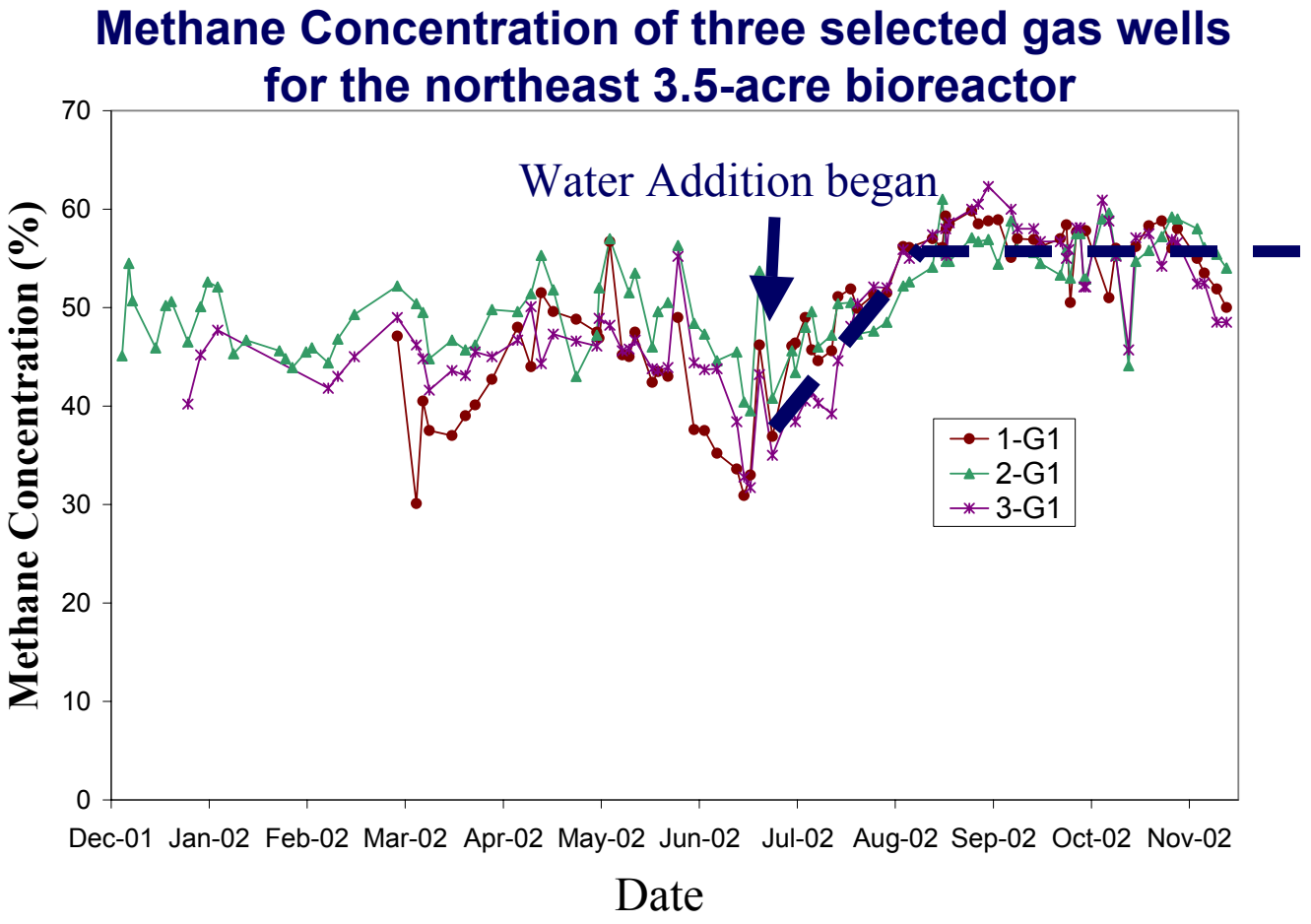
Full-Scale Project Results



Full-scale Project Results

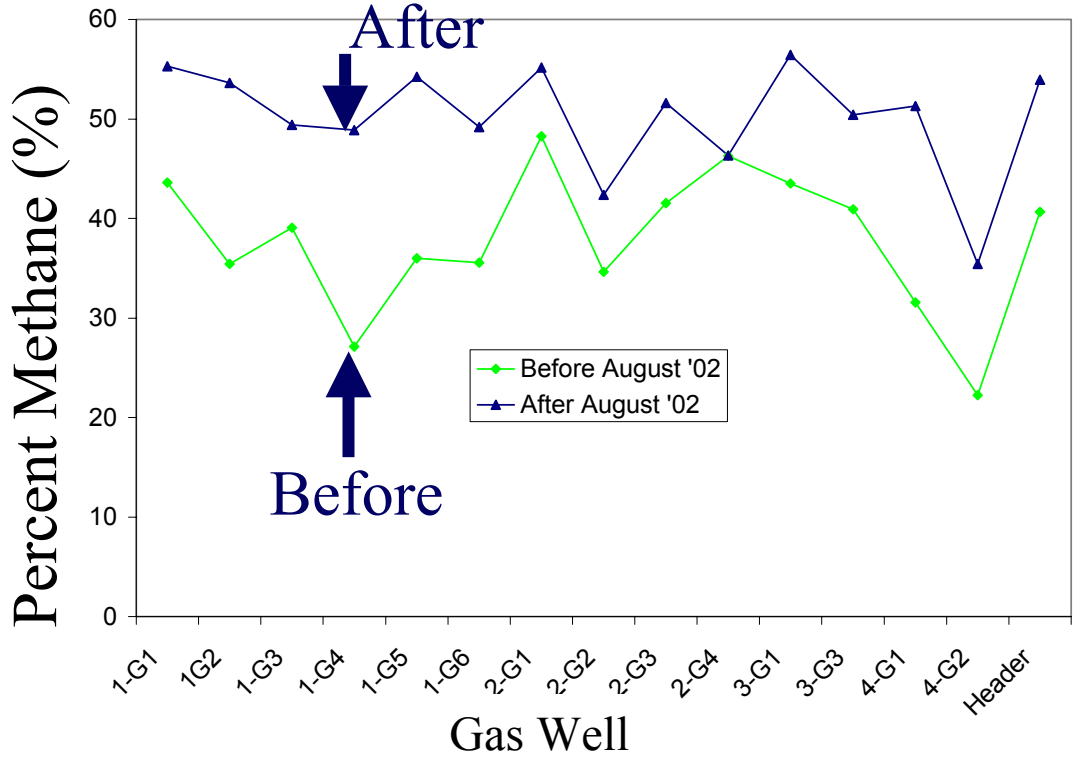


Full-scale Project Results



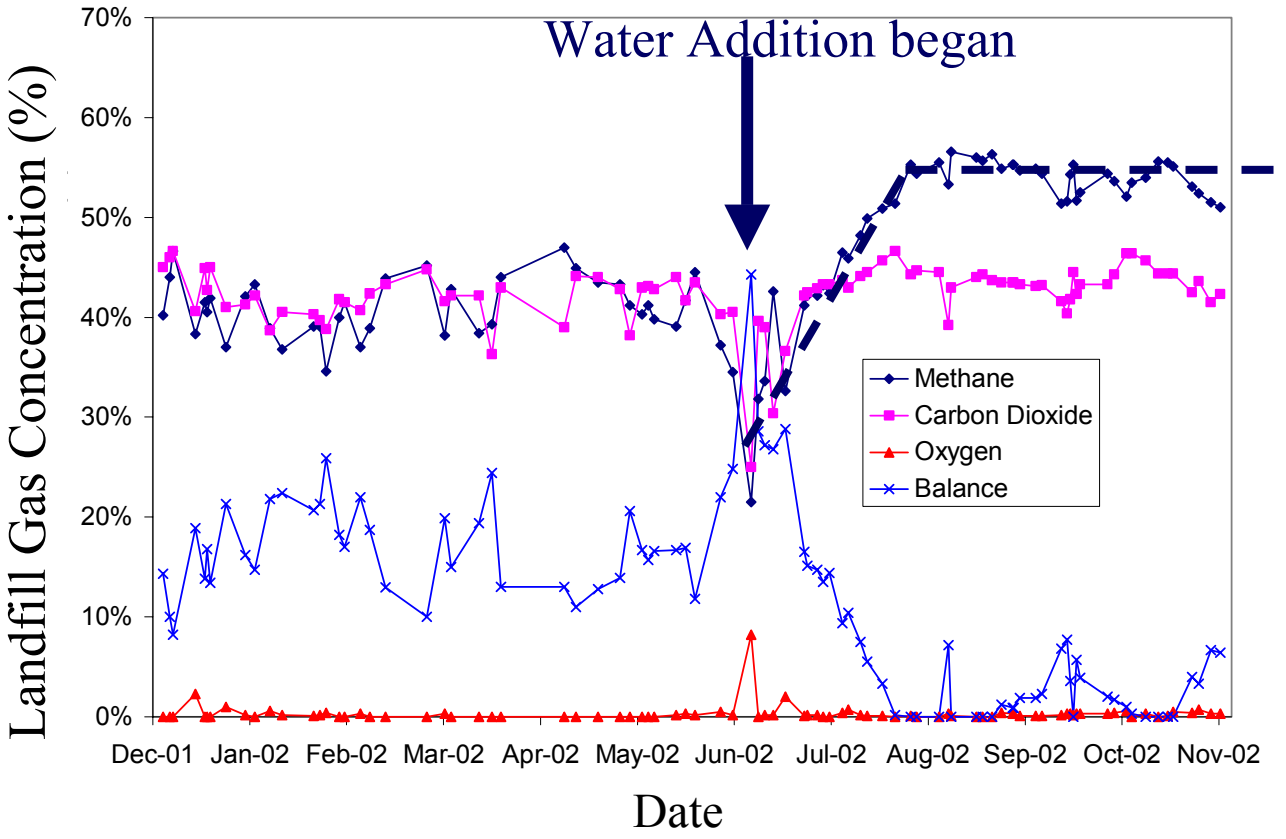
Full-scale Project Results

Average methane concentration of each individual gas wells before and after leachate addition (3.5-acre cell)

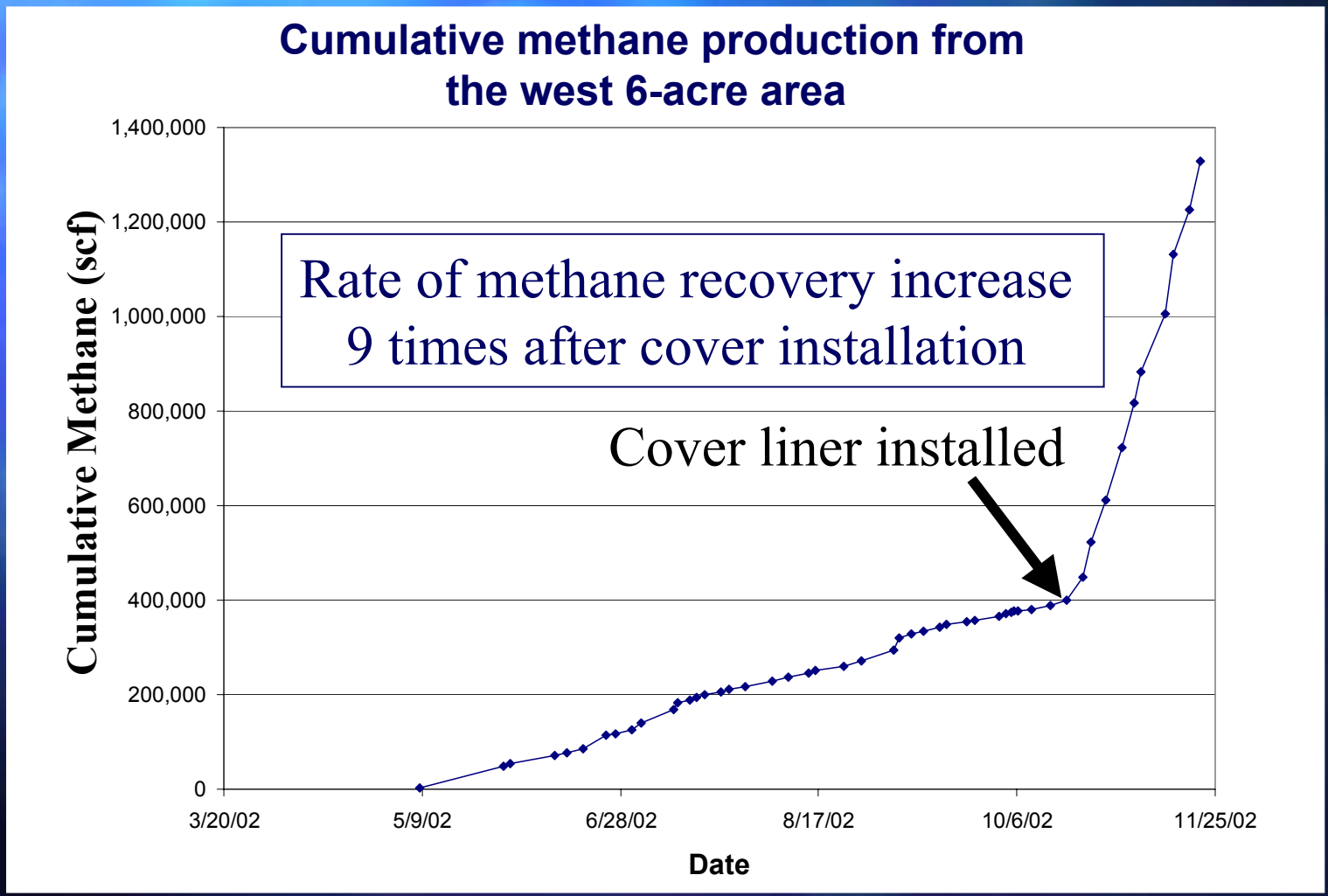


Full-scale Project Results

Landfill gas concentrations from gas header line for northeast 3.5-acre cell

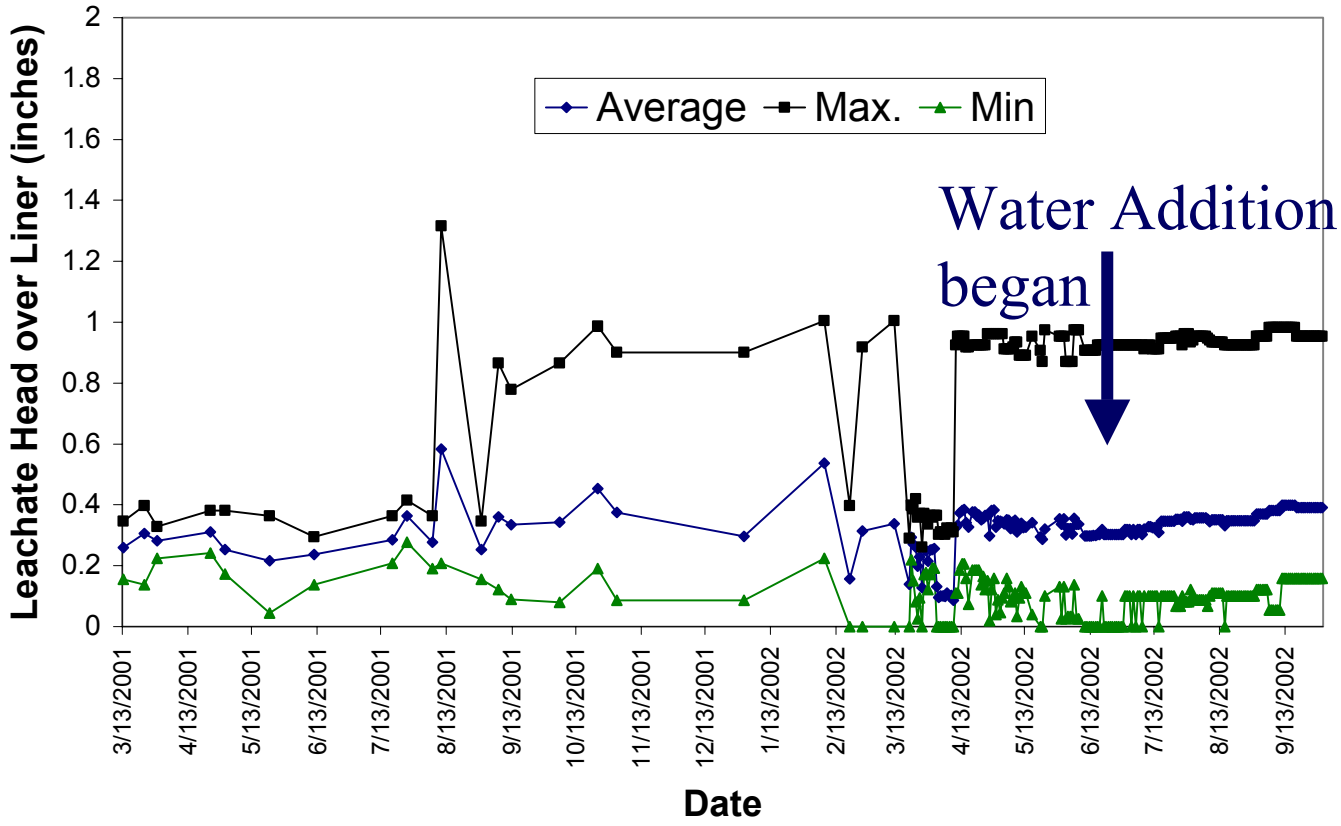


Full-scale Project Results

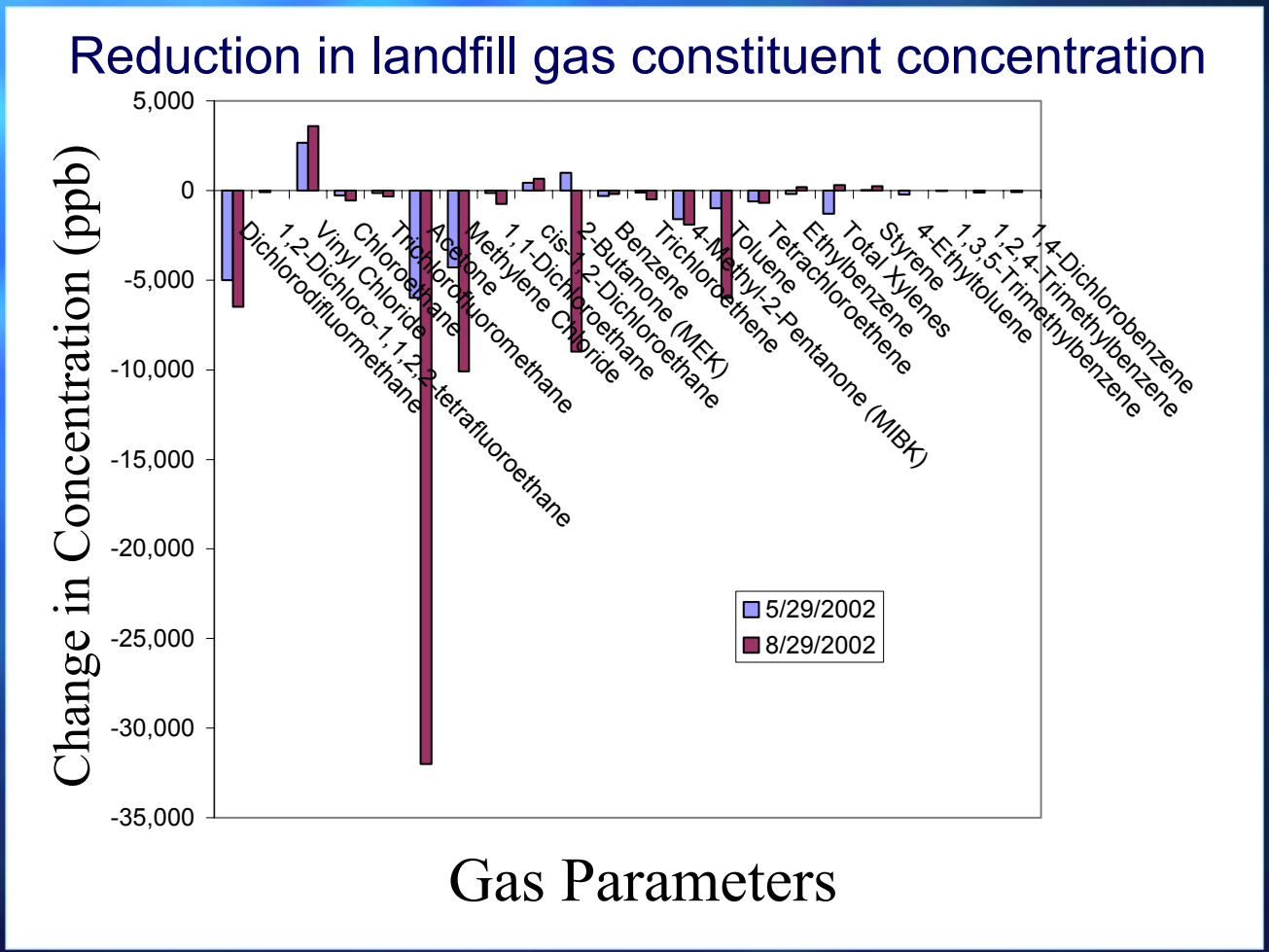


Full-scale Project Results

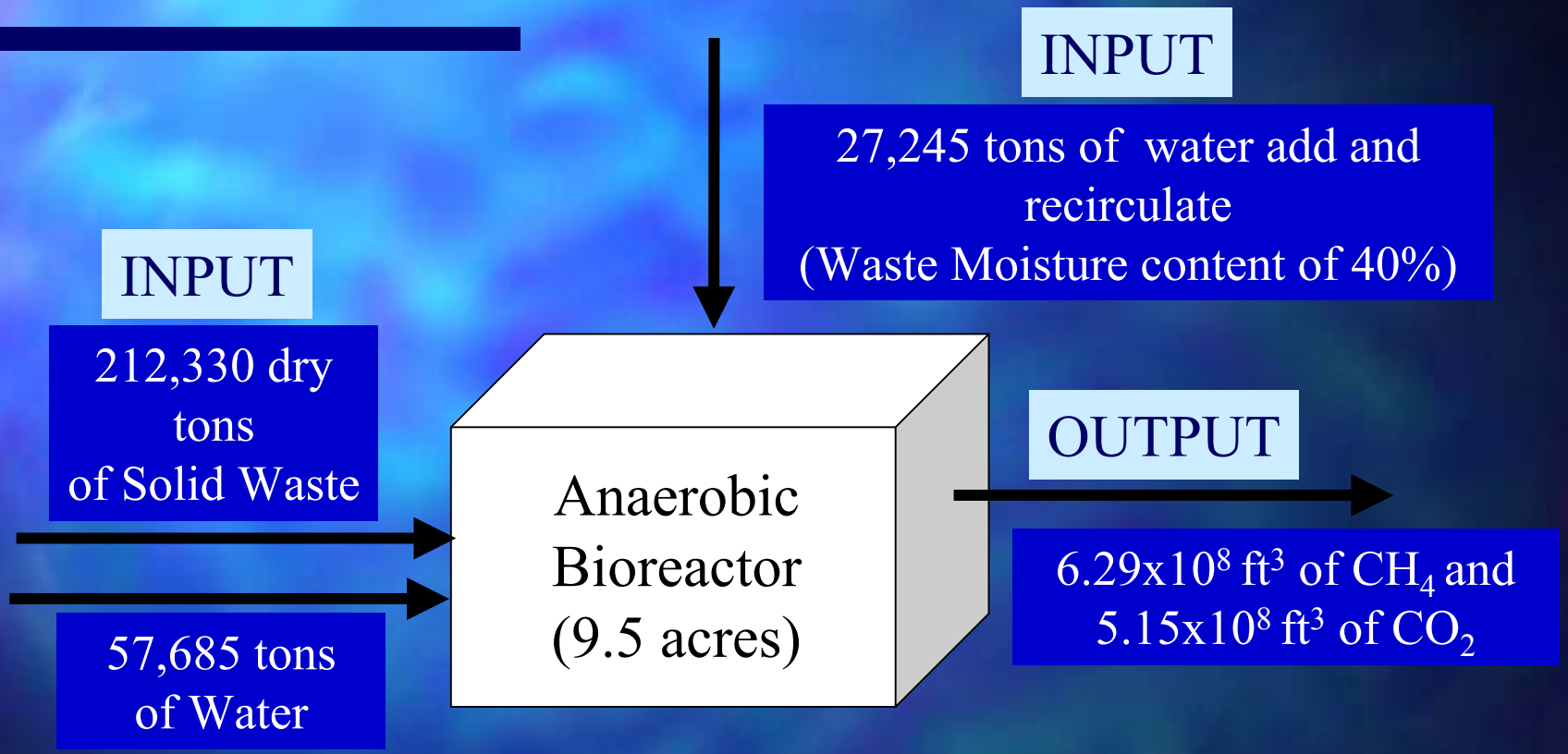
Leachate head over the liner for the full-scale bioreactor project



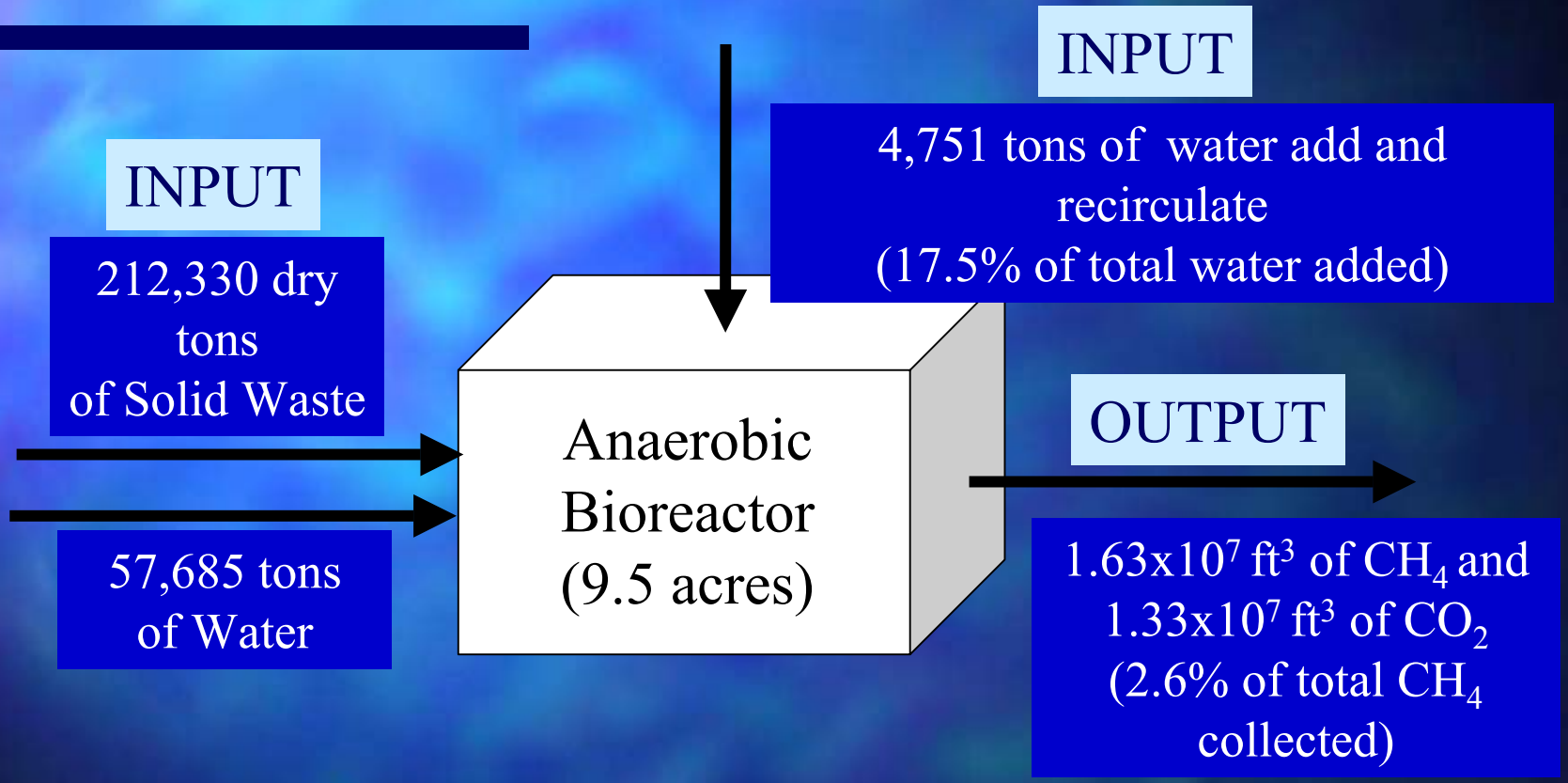
Full-Scale Project Results



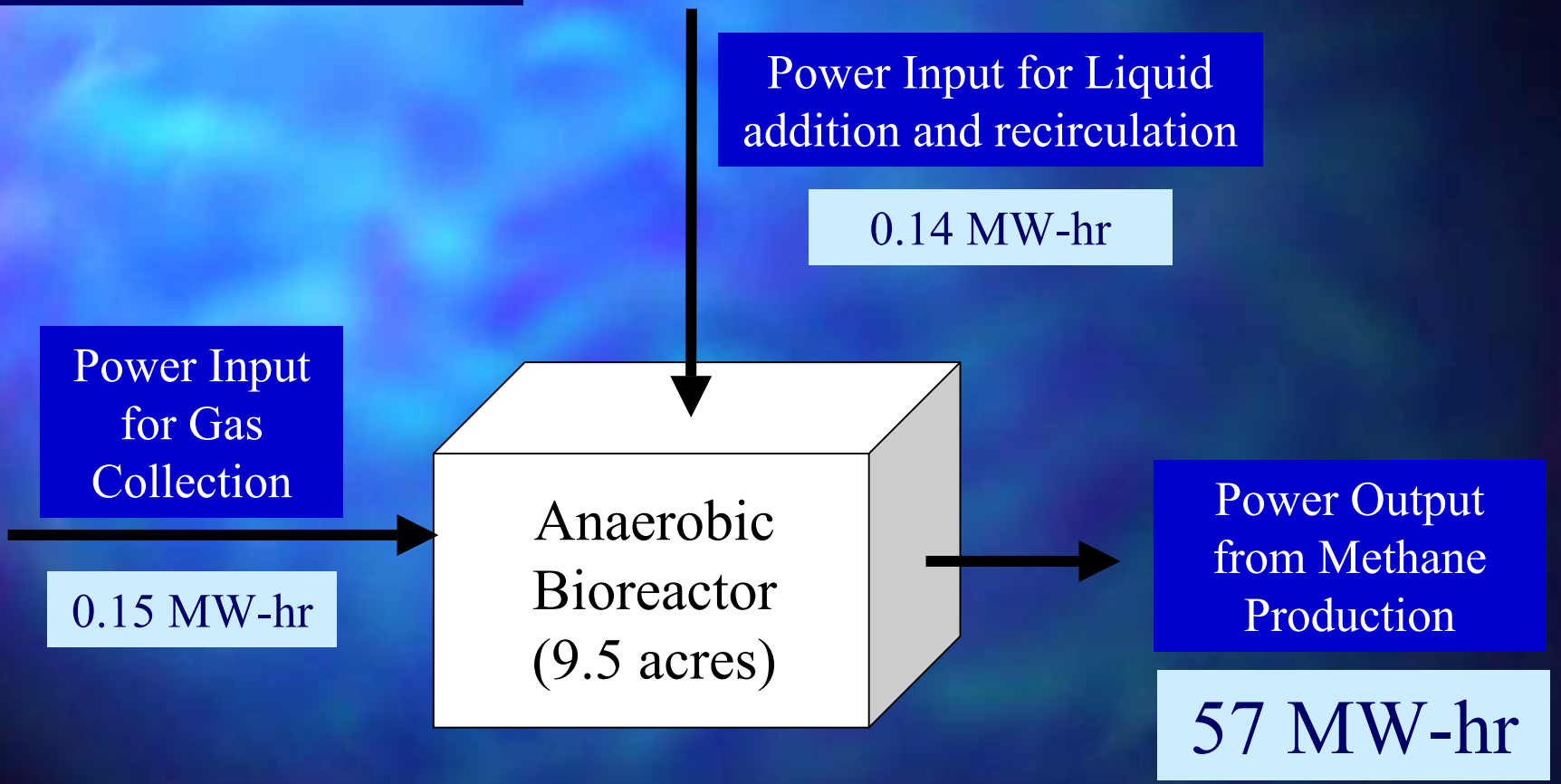
Total Mass Balance for Anaerobic Bioreactor



Current Mass Balance for Anaerobic Bioreactor

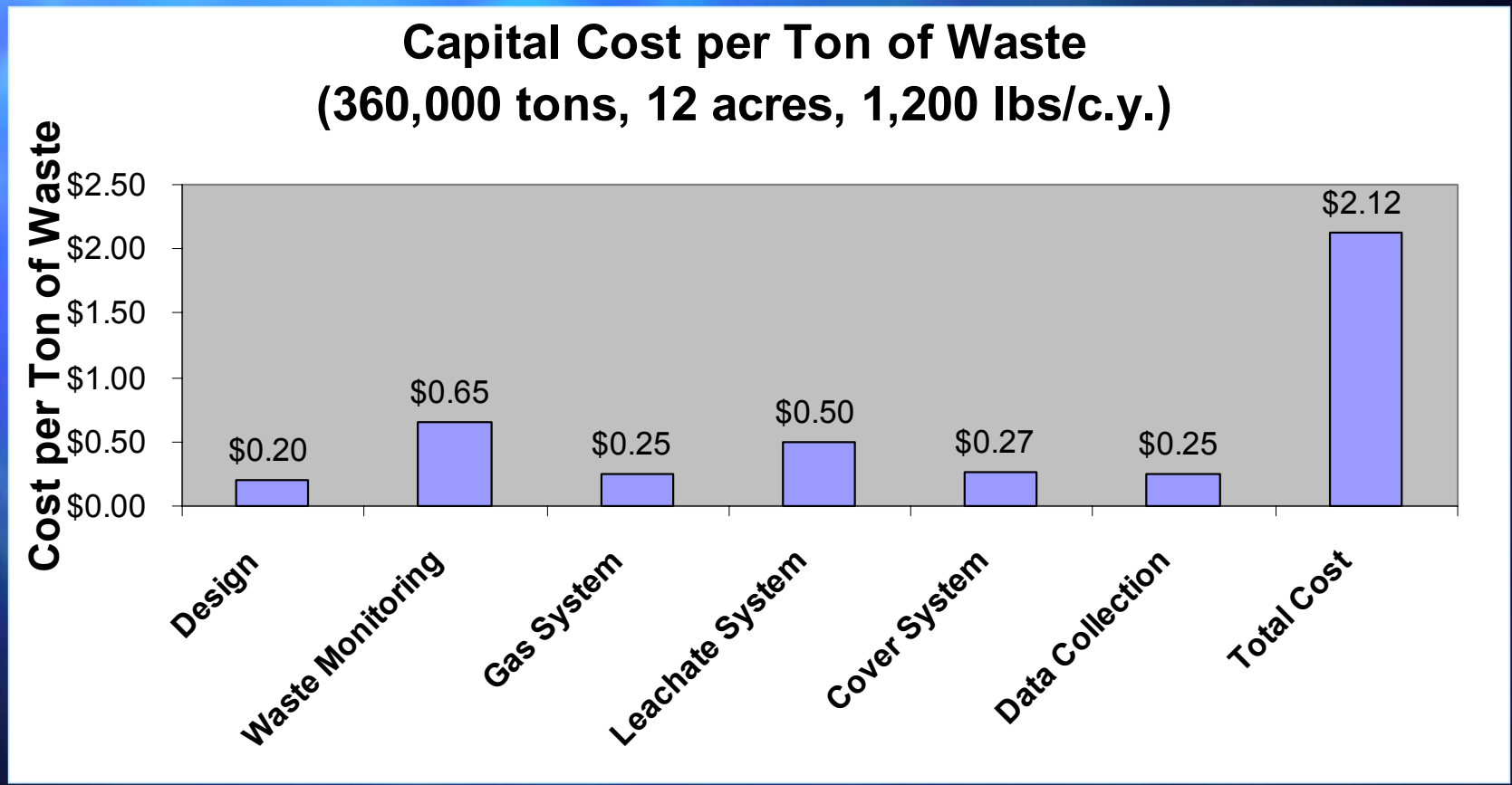


Total Energy Balance for Anaerobic Bioreactor

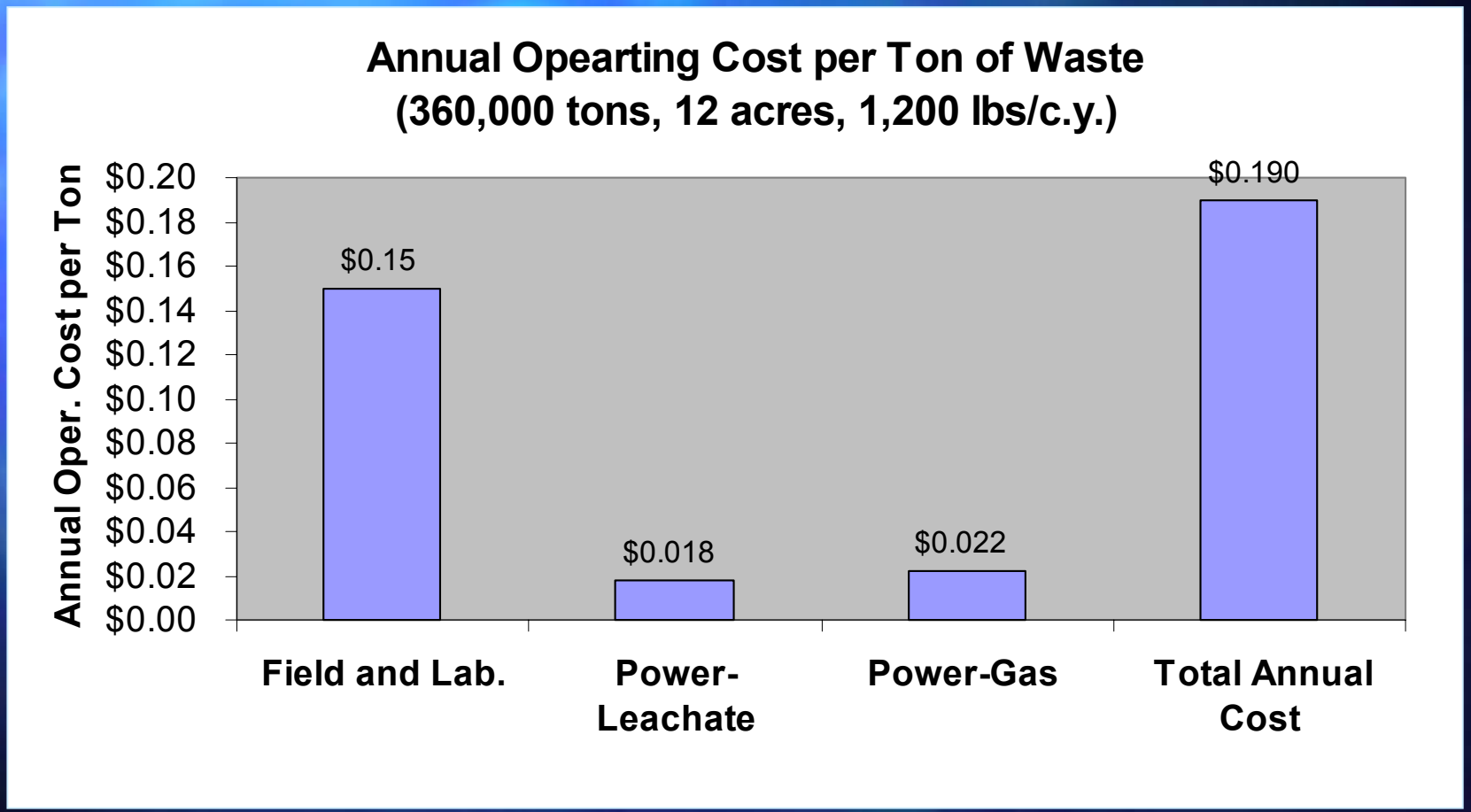


Parasitic Losses = 0.51% ~ < 1 %

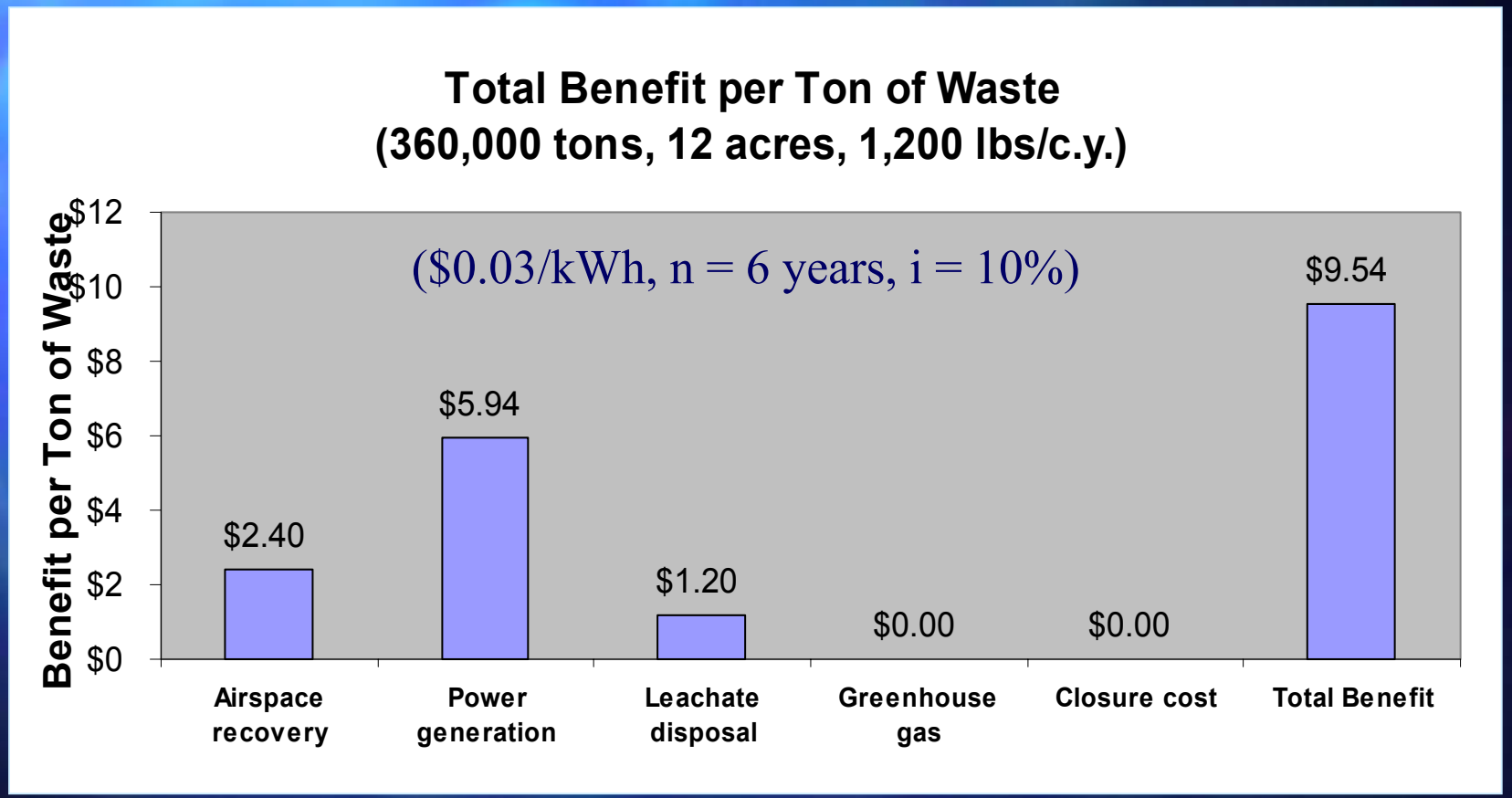
Full-scale Project Economics



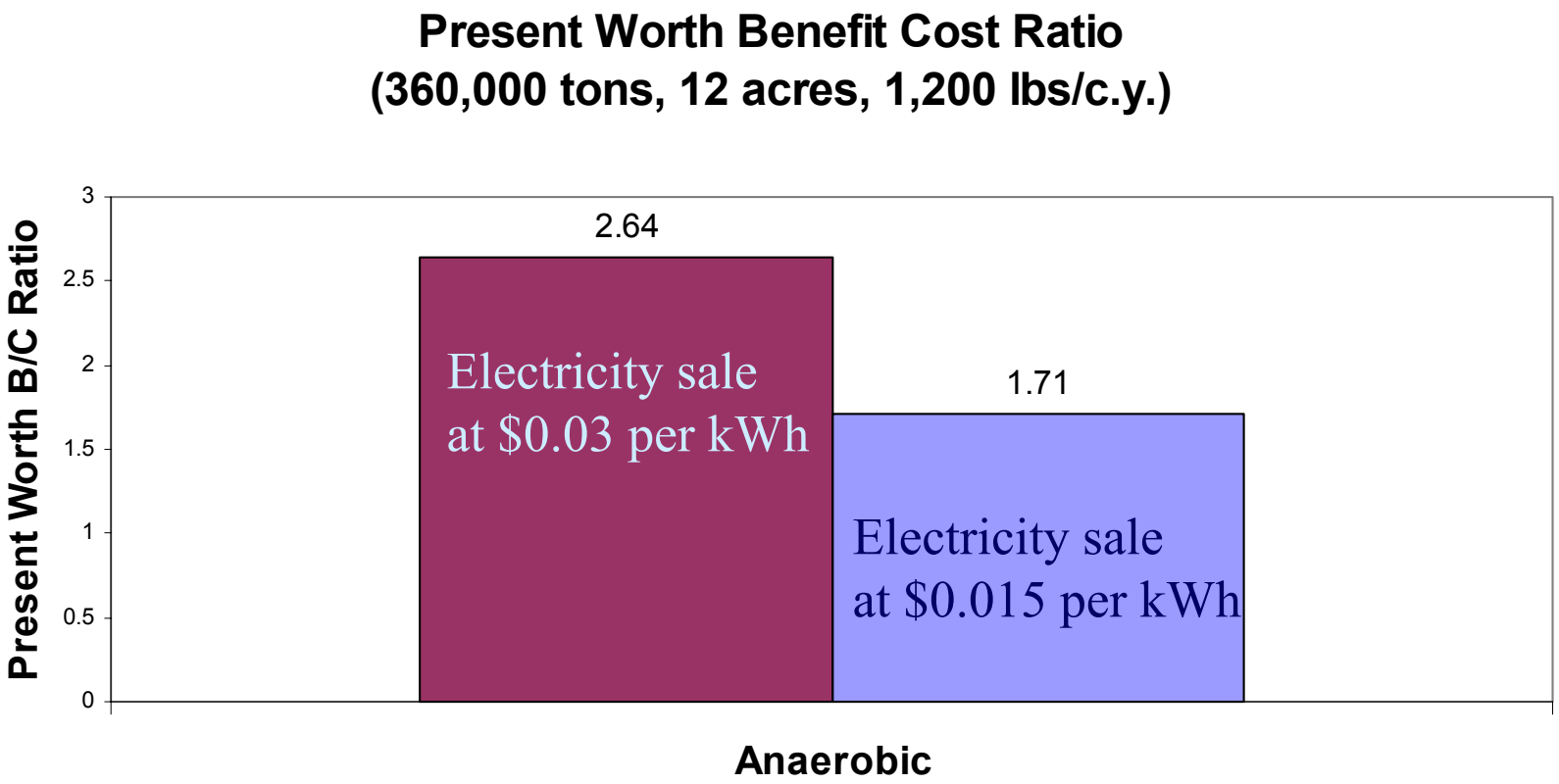
Full-scale Project Economics



Full-scale Project Economics



Full-scale Project Economics



Design, Construction, and Operation Challenges

- Liner cap design and construction
- Installation of instrumentation after waste filling
- Securing installed liner and penetration of pipes through the cap
- Leachate injection system & precipitation of calcium carbonate
- HDPE Injection lines-drilling and installing fittings
- Pressurized (liquid) Leachate injection system-inspection for leaks

Conclusions

- Bioreactors can:
  - Be constructed with normal landfill equipments
  - Be operated in a safe manner
  - Be instrumented during waste filling phase
  - Collect landfill gas under cover to reduce fugitive emissions via horizontal gas collection system
  - Be operated to slowly inject leachate and prevent hydrostatic head build up over the base liner

Conclusions

- Bioreactors can:
  - Be operated to inject leachate horizontally to distribute moisture uniformly
  - Be designed to be operated by a SCADA system
  - Be designed Collect real-time field data for monitoring, control, and data collection
  - Be have a master database for data management and reporting
  - Be economical to construct and operate

THE END

QUESTIONS?

Thank You!